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EFFECT OF X-RADIATION, RADIOMIMETIC SUBSTANCES AND SURGICAL TRAUMA ON THE SULFHYDRYL CONTENT OF PLASMA; Final Report, by Bernard Shacter, Helen Supplee, and Cecil Entenman. Nov. 27, 1951. 22p. (AD-333(B); Technical Objective AW-6; U20409)

AD-334(B) 1594
Naval Radiological Defense Lab.
EFFECT OF X-RADIATION AND LAPAROTOMY ON THE POLYSACCHARIDE CONTENT OF PLASMA; RELATIONSHIP TO PLASMA SULFHYDRYL CHANGES; Final Report, by Bernard Shacter, Helen Supplee, and Cecil Entenman. Nov. 27, 1951. 11p. (AD-334(B); Technical Objective AW-6; U20432)

BM-RI-4822 1727
Bureau of Mines
PROCESSES FOR RECOVERING VANADIUM FROM WESTERN PHOSPHATES, by Floyd H. Banning and R. T. C. Rasmussen. Dec. 1951. 44p. (BM-RI-4822)

BM-RI-4835 1627
Bureau of Mines
EXPLOSIVE CHARACTERISTICS OF TITANIUM, ZIRCONIUM, THORIUM, URANIUM AND THEIR HYDRIDES, by Irving Hartmann, John Nagy, and Murray Jacobson. Dec. 1951. 54p. (BM-RI-4835)

CEA-95 1698
Commissariat a l'Énergie Atomique (France)
[PREPARATION OF $NaBr^{80,82}$ OF HIGH SPECIFIC ACTIVITY IN THE CHATILLON PILE.] PREPARATION DE ^{80,82} BrNa DE GRANDE ACTIVITÉ SPÉCIFIQUE A LA PILE DE CHATILLON, by C. Fisher, C. Herczeg, and H. Laurent. Oct. 1951. 10p. (CEA-95)

CEA-99 1699
Commissariat a l'Énergie Atomique (France)
[MICROSYNTHESES USING C^{13} OR C^{14}. II. MICROPREPARATIONS OF METHYL ALCOHOL, METHYL IODIDE, AND SODIUM ACETATE LABELED IN THE METHYL GROUP.] MICROSYNTHÈSES POUR L'EMPLOI DE CARBONE 13 OU DE CARBONE 14. II. MICROPRÉPARATIONS D'ALCOOL MÉTHYLIQUE D'IODURE DE MÉTHYLE ET D'ACÉTATE DE SODIUM MARQUÉ SUR LE GROUPEMENT MÉTHYLE, by C. Baret and L. Pichat. Nov. 1951. 12p. (CEA-99)

CI-110 1686*
Toronto Univ. (Canada)
A CONTINUOUS LIQUID-LIQUID EXTRACTOR FOR SOLVENTS OF VARIOUS DENSITIES, by H. A. Bewick, J. E. Currah, and F. E. Beamish. Feb. 22, 1946. 15p. (CI-110)

CRC-470 1857
Atomic Energy Project (Canada)
THERMAL NEUTRON FISSION YIELDS OF U^{233} AND U^{235}, by W. E. Grummitt and G. Wilkinson. Mar. 1951. 13p. (CRC-470)

CRLIR-64 1611
Chemical and Radiological Lab., Army Chemical Center
MAXIMUM ALLOWABLE CONCENTRATIONS OF FISSION PRODUCTS IN THE AIR AS A FUNCTION OF EXPOSURE TIME AND TIME AFTER DETONATION, by Robert L. Harvey. Nov. 9, 1951. 17p. (CRLIR-64; U20189)

NACA-ARR-L4I11c 1711
Langley Memorial Aeronautical Lab., NACA
HIGH-ALTITUDE COOLING. IV. INTERCOOLERS, by K. F. Rubert. Sept. 1944. 15p. (NACA-ARR-L4I11c)

NACA-RM-E51G02 1712
Lewis Flight Propulsion Lab., NACA
EXPERIMENTAL INVESTIGATION OF FORCED-CONVECTION HEAT-TRANSFER CHARACTERISTICS OF LEAD-BISMUTH EUTECTIC, by Bernard Lubarsky. Sept. 20, 1951. 30p. (NACA-RM-E51G02)

NACA-TN-2599 1713
Lewis Flight Propulsion Lab., NACA
EXPERIMENTAL DETERMINATION OF TIME CONSTANTS AND NUSSELT NUMBERS FOR BARE-WIRE THERMOCOUPLES IN HIGH-VELOCITY AIR STREAMS AND ANALYTIC APPROXIMATION OF CONDUCTION AND RADIATION ERRORS, by Marvin D. Scadron and Isidore Warshawsky. Jan. 1952. 81p. (NACA-TN-2599)

NAVORD-1837 1714
Naval Ordnance Lab.
ON SOME TWO- AND THREE-DIMENSIONAL PROBLEMS IN HEAT CONDUCTION, by Arnold N. Lowan. Naval Ordnance Lab. and Yeshiva Univ. August 20, 1951. 37p. (NAVORD-1837; U20530)

NBS-1004 1735
National Bureau of Standards
CORROSION OF SURFACE TREATED ALUMINUM ALLOYS, by Fred M. Reinhart. May 25, 1951. 9p. (NBS-1004; U18492)

NBS-1344 1748
National Bureau of Standards
SUPERCONDUCTIVITY OF THE ISOTOPES OF TIN, by E. Maxwell. Nov. 26, 1951. 28p. (NBS-1344)

NBS-1419 1700
National Bureau of Standards
PREPARATION OF D-MANNITOL-1,6-C^{14} AND ITS CONVERSION TO D-FRUCTOSE-1,6-C^{14} BY ACETOBACTER SUBOXYDANS, by H. S. Isbell and J. V. Karabinos. Feb. 1, 1952. 14p. (NBS-1419)

NP-3558 1768
Research Lab. of Electronics, Mass. Inst. of Tech.
ELECTRON DENSITY DISTRIBUTION IN A HIGH FREQUENCY DISCHARGE IN THE PRESENCE OF PLASMA RESONANCE, by W. P. Allis, Sanborn C. Brown, and Edgar Everhart. July 16, 1951. 9p. (NP-3558; Technical Report No. 210; U20228)

NP-3559 1781
Research Lab. of Electronics, Mass. Inst. of Tech.
AN FM-AM MULTIPLIER OF HIGH ACCURACY AND WIDE RANGE, by Robert Price. Oct. 4, 1951. (NP-3559; Technical Report No. 213; U20226)

NP-3563 1687
Institute for the Study of Rate Processes, Univ. of Utah
THEORY OF ADSORPTION ON ION EXCHANGE RESINS, by Milton E. Wadsworth and Melvin A. Cook. July 1, 1951. 20p. (NP-3563; Technical Report No. VII; U20311)

NP-3564 1596
Naval School of Aviation Medicine, Pensacola
FURTHER EVALUATION OF PRESENT DAY KNOWLEDGE OF COSMIC RADIATION IN TERMS OF THE HAZARD TO HEALTH, by Hermann J. Schaefer. Aug. 15, 1951. 23p. (NP-3564; U19329)

NP-3573 1736
Battelle Memorial Inst.
THE PLASTICITY OF MOLYBDENUM SINGLE CRYSTALS; TERMINAL REPORT; JANUARY 1, 1950 TO JUNE 15, 1951, by N. K. Chen and R. Maddin. June 21, 1951. 25p. (NP-3573; U20132)

NP-3578 1635
Louisiana State Univ.
POLAROGRAPHIC STUDY OF THE KINETICS OF IONIC RECOMBINATION AND COMPARISON WITH ONSAGER'S THEORY, by Paul Delahay and Thomas J. Adams. Sept. 1951. 19p. (NP-3578; Technical Report No. 2; U20200)

NP-3580 1756
Engineering Research Inst., Univ. of Mich.
THE EFFECT OF ATMOSPHERIC TEMPERATURE VARIATIONS ON COSMIC-RAYS UNDERGROUND, by W. E. Hazen and Noah Sherman. Dec. 31, 1951. 81p. (NP-3580)

NP-3581 1749
New York Univ.
FIRST QUARTERLY REPORT FOR MONTHS INCLUDING FEBRUARY, MARCH, APRIL ON RESEARCH OF FLUORESCENCE AND CONDUCTIVITY PHENOMENA, by Hartmut Kallmann, Director. May 1951. 71p. (NP-3581; U19981)

NP-3582 1800
Material Lab., New York Naval Shipyard
INVESTIGATION OF PULSES FROM GEIGER-MUELLER TUBES OPERATED UNDER MINIMUM LOADING CONDITIONS USING OSCILLOGRAPHIC TECHNIQUES; FINAL REPORT, by W. G. Egan and A. C. Clark. June 22, 1951. 49p. (NP-3582; NE 091105)

NP-3584 1636
Wisconsin Univ.
THE CHEMISTRY OF ZIRCONIUM AND HAFNIUM; FOURTH QUARTERLY REPORT; NOVEMBER 1, 1950–JANUARY 31, 1951. [nd] 16p. (NP-3584)

NP-3585 1750
Research Lab. of Electronics, Mass. Inst. of Tech.
QUARTERLY PROGRESS REPORT, by A. G. Hill, J. B. Wiesner, and G. G. Harvey. Jan. 15, 1952. 103p. (NP-3585)

NP-3586 1751
Research Lab. of Electronics, Mass. Inst. of Tech.
EXPERIMENTAL STUDY OF NONLINEAR DEVICES BY CORRELATION METHODS, by L. Weinberg and L. G. Kraft. Jan. 20, 1951. 29p. (NP-3586; Technical Report No. 178)

NP-3587 1637
Institute for the Study of Rate Processes, Univ. of Utah
SOME ASPECTS OF CATALYTIC HYDROGENATION; III. ETHYLENE, by Charles B. Colburn, Merrill B. Wallenstein, Ransom B. Parlin, and Bruno J. Zwolinski. Dec. 1, 1951. (NP-3587; Technical Report No. VIII)

NP-3590 1701
Minnesota Mining and Manufacturing Co.
QUARTERLY PROGRESS REPORT NO. 9; MAY, 1951 TO JULY, 1951, by W. H. Pearlson. 24p. (NP-3590; Quarterly Progress Report No. 9)

NP-3591 1833
Institute for Nuclear Studies, Univ. of Chicago
NUCLEAR PHYSICS AND THE PHYSICS OF FUNDAMENTAL PARTICLES; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, SEPTEMBER 17 TO 22, 1951, by Jay Orear, A. H. Rosenfeld, and R. A. Schluter, eds. [nd] 211p. (NP-3591)

NP-3591(sect.I) 1818
Institute for Nuclear Studies, Univ. of Chicago
PRESENT STATUS OF KNOWLEDGE CONCERNING FUNDAMENTAL PARTICLES, sect.I of NUCLEAR PHYSICS AND THE PHYSICS OF FUNDAMENTAL PARTICLES; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, SEPTEMBER 17 TO 22, 1951, by Jay Orear, A. H. Rosenfeld, and R. A. Schluter, eds. [nd] 17p. (NP-3591(sect.I))

NP-3591(sect.IA) 1883
Institute for Nuclear Studies, Univ. of Chicago
HIGH ENERGY ACCELERATOR DESIGN, sect.IA of NUCLEAR PHYSICS AND THE PHYSICS OF FUNDAMENTAL PARTICLES; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, SEPTEMBER 17 TO 22, 1951, by Jay Orear, A. H. Rosenfeld, and R. A. Schluter, eds. [nd] 11p. (NP-3591(sect.IA))

NP-3591(sect.IB) 1859
Institute for Nuclear Studies, Univ. of Chicago
REACTIONS OF LIGHT NUCLEI, sect.IB of NUCLEAR PHYSICS AND THE PHYSICS OF FUNDAMENTAL PARTICLES; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, SEPTEMBER 17 TO 22, 1951, by Jay Orear, A. H. Rosenfeld, and R. A. Schluter, eds. [nd] 26p. (NP-3591(sect.IB))

NP-3591(sect.II) 1819
Institute for Nuclear Studies, Univ. of Chicago
MESON THEORY, sect.II of NUCLEAR PHYSICS AND THE PHYSICS OF FUNDAMENTAL PARTICLES; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, SEPTEMBER 17 TO 22, 1951, by Jay Orear, A. H. Rosenfeld, and R. A. Schluter, eds. [nd] 13p. (NP-3591(sect.II))

NP-3591(sect.IIA) 1793
Institute for Nuclear Studies, Univ. of Chicago
MASS SPECTROSCOPY, sect.IIA of NUCLEAR PHYSICS AND THE PHYSICS OF FUNDAMENTAL PARTICLES; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, SEPTEMBER 17 TO 22, 1951, by Jay Orear, A. H. Rosenfeld, and R. A. Schluter, eds. [nd] 19p. (NP-3591(sect.IIA))

NP-3591(sect.IIB) 1887
Institute for Nuclear Studies, Univ. of Chicago
SCATTERING OF NUCLEAR PARTICLES, AND NUCLEAR FORCES, sect.IIB of NUCLEAR PHYSICS AND THE PHYSICS OF FUNDAMENTAL PARTICLES; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, SEPTEMBER 17 TO 22, 1951, by Jay Orear, A. H. Rosenfeld, and R. A. Schluter, eds. [nd] 22p. (NP-3591(sect.IIB))

NP-3591(sect.IIC) 1931
Institute for Nuclear Studies, Univ. of Chicago
ON THE INVERSION PROPERTIES OF SPIN ½ FIELDS (SPECIAL SESSION), sect.IIC of NUCLEAR PHYSICS AND THE PHYSICS OF FUNDAMENTAL PARTICLES; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, SEPTEMBER 17 TO 22, 1951, by Jay Orear, A. H. Rosenfeld, and R. A. Schluter, eds. [nd] 2p. (NP-3591(sect.IIC))

NP-3591(sect.III) 1754
Institute for Nuclear Studies, Univ. of Chicago
NUCLEAR ABUNDANCES AND COSMOGONY, sect.III of NUCLEAR PHYSICS AND THE PHYSICS OF FUNDAMENTAL PARTICLES; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, SEPTEMBER 17 TO 22, 1951, by Jay Orear, A. H. Rosenfeld, and R. A. Schluter, eds. [nd] 13p. (NP-3591(sect.III))

NP-3591(sect.IV) 1839
Institute for Nuclear Studies, Univ. of Chicago
NUCLEAR STRUCTURE AND ISOMERISM, sect.IV of NUCLEAR PHYSICS AND THE PHYSICS OF FUNDAMENTAL PARTICLES; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, SEPTEMBER 17 TO 22, 1951, by Jay Orear, A. H. Rosenfeld, and R. A. Schluter, eds. [nd] 19p. (NP-3591(sect.IV))

NP-3591(sect.IVA) 1909
Institute for Nuclear Studies, Univ. of Chicago
BETA-RAY SPECTRA AND NEUTRINOS, sect.IVA of NUCLEAR PHYSICS AND THE PHYSICS OF FUNDAMENTAL PARTICLES; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, SEPTEMBER 17 TO 22, 1951, by Jay Orear, A. H. Rosenfeld, and R. A. Schluter, eds. [nd] 24p. (NP-3591(sect.IVA))

NP-3591(sect.IVB) 1860
Institute for Nuclear Studies, Univ. of Chicago
NEUTRONS AND FISSION, sect.IVB of NUCLEAR PHYSICS AND THE PHYSICS OF FUNDAMENTAL PARTICLES; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, SEPTEMBER 17 TO 22, 1951, by Jay Orear, A. H. Rosenfeld, and R. A. Schluter, eds. [nd] 11p. (NP-3591(sect.IVB))

NP-3591(sect.V) 1861
Institute for Nuclear Studies, Univ. of Chicago
GAMMA RAYS AND PHOTONUCLEAR REACTIONS, sect.V of NUCLEAR PHYSICS AND THE PHYSICS OF FUNDAMENTAL PARTICLES; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, SEPTEMBER 17 TO 22, 1951, by Jay Orear, A. H. Rosenfeld, and R. A. Schluter, eds. [nd] 27p. (NP-3591(sect.V))

NP-3592 1695
Duke Univ.
TECHNICAL REPORT NO. 6, by H. Sponer. Dec. 20, 1951. 68p. (NP-3592; Technical Report No. 6; U20378)

NP-3592(sect.4) 1769
Duke Univ.
ON THE CALCULATION OF ELECTRONIC LEVELS IN PYRIDINE AND THE ISOMERIC PICOLINES, sect.4 of TECHNICAL REPORT NO. 6, by Gertrud P. Nordheim and H. Sponer. Dec. 20, 1951. 11p. (NP-3592(sect.4))

NP-3592(sect.5) 1929
Duke Univ.
SPECTROSCOPIC STUDIES IN THE NEAR ULTRAVIOLET OF THE THREE ISOMERIC DIMETHYLBENZENE VAPORS. I. ABSORPTION AND FLUORESCENCE SPECTRA OF PARA DIMETHYLBENZENE; sect.5 of TECHNICAL REPORT NO. 6, by C. D. Cooper and M. L. N. Sastri. Dec. 20, 1951. 19p. (NP-3592(sect.5))

NP-3593 1722
Illinois Univ. Engineering Experiment Station
EUROPEAN RESEARCH ON THE BEHAVIOR OF MATERIALS AND EXPERIMENTAL STRESS ANALYSIS, by Thomas J. Dolan. Nov. 1951. 42p. (NP-3593)

NP-3599 1770
Research Lab. of Electronics, Mass. Inst. of Tech.
PROPAGATION OF DISTURBANCES IN ACCELERATED ELECTRON STREAMS; I. ONE-DIMENSIONAL ACCELERATED STREAMS, by L. D. Smullin. July 12, 1951. 6p. (NP-3599; Technical Report No. 207; U20024)

NP-3602 1782
Columbia Radiation Lab., Columbia Univ.
PROGRESS REPORT; THIRD QUARTERLY REPORT FOR THE YEAR 1951. Sept. 30, 1951. 19p. (NP-3602; U20187)

NP-3611 1752
University Coll., London (England)
PROCEEDINGS OF THE CONFERENCE ON DYNAMICS OF IONIZED MEDIA. Apr. 1951. 164p. (NP-3611)

NP-3613 1723*
General Electric Co.
METALLURGICAL INVESTIGATIONS FOR SELECTION OF MATERIALS SUBJECTED TO AN ENVIRONMENT OF LIQUID LEAD-BISMUTH ALLOY; FINAL REPORT, by R. C. Grassi and D. W. Bainbridge. Aug. 1949. 63p. (NP-3613; U10527)

NP-3619 1853*
Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
PRODUCTION OF RADIONUCLIDES, by John W. Irvine, Jr. 33p. [nd] (NP-3619)

NP-3620 1840*
New York Univ.
ON THE ACTIVATION ENERGY OF NUCLEAR FISSION, by R. D. Present, F. Reines, and J. K. Knipp. New York Univ. and Purdue Univ. [nd] 26p. (NP-3620)

NP-3624 1783
New Mexico Univ.
FREQUENCY MODULATED AUDIO OSCILLATORS (thesis), by James L. Dossey. 1951. 79p. (NP-3624)

PD-223 1831
Atomic Energy Project (Canada)
RESEARCH IN NEUTRON PHYSICS AT CHALK RIVER, by B. W. Sargent. Mar. 27, 1947. Decl. Mar. 1948. 12p. (PD-223)

PD-224 1854*
Atomic Energy Project (Canada)
THE LOW POWER PILE AT CHALK RIVER, by B. W. Sargent. March 25, 1947. Decl. March 1948. 10p. (PD-224)

PR-P-12-E 1802
Atomic Energy Project (Canada)
PROGRESS REPORT AUGUST 16 – NOVEMBER 15, 1951; ELECTRONICS BRANCH, by J. Hardwick. [nd] 14p. (PR-P-12-E)

RAD-207(RAND) 1589*
RAND Corp.
SOME CONSIDERATIONS AFFECTING THE DESIGN OF NUCLEAR TURBOJET ENGINES, by A. P. Graff. Sept. 2, 1947. 25p. (RAD-207(RAND))

GENERAL

ATOMIC BOMBS AND WARFARE

1587

ATOMIC WAR AND GAS WAR; DANGERS AND DEFENSE. J. Maisin. Bruxelles-méd. 32, 113-19(1952) Jan. 20. (In French)

The author stresses that the atomic bomb, like gas bombs, will be used only if the great cost of an attack and the certainty of reprisal are outweighed by the results obtained in destruction of industrial potential and demoralization of the population. Proper civil-defense arrangements and familiarization with the effects of atomic weapons are urged. The article compares the number of victims from atomic attacks with those from other types of warfare, and discusses the lethality of nuclear radiation from the bomb.

1588

ATOMIC WAR AND GAS WAR. DANGERS AND DEFENSE. (CONCLUSION). J. Maisin. Bruxelles-méd. 32, 163-77 (1952) Jan. 27. (In French)

After diagraming on a hypothetical city the area of radioactive contamination which would be caused by an underwater atomic explosion, the author discusses the symptoms and treatment of victims suffering from burns or radiation sickness.

ATOMIC POWER

1589

RAND Corp.

SOME CONSIDERATIONS AFFECTING THE DESIGN OF NUCLEAR TURBOJET ENGINES, by A. P. Graff. Sept. 2, 1947. 25p. (RAD-207(RAND))

BIOLOGY AND MEDICINE

1590

Duke Univ.

THE EFFECT OF OXIDIZED FATTY ACIDS ON THE ACTIVITY OF CERTAIN OXIDATIVE ENZYMES, by Frederick Bernheim, Karl M. Wilbur, and Carolyn B. Kenaston. [nd] 16p. (AECU-1857)

Incubation of washed tissue suspensions or mitochondria with ascorbic acid inactivates a number of enzymes including the succinoxidase, cytochrome oxidase, and choline oxidase. It has no effect on liver alkaline phosphatase or brain cholinesterase. The extent of inactivation parallels the amount of oxidized fatty acid formed as measured by the thiobarbituric acid test. Quercitin which inhibits oxidation prevents the inactivation. Methyl linolenate previously exposed to ultraviolet light also inhibits the oxidative enzymes. In the same concentrations unexposed linolenate has little or no effect. The inhibition by oxidized linolenate occurs slowly, which indicates a slow reaction with some enzyme component. (auth)

1591

Oak Ridge National Lab.

THE ISOLATION OF TRIPLOID YEAST (abstract), by Seymour Pomper. [nd] 1p. (AECU-1870)

Saccharomyces cerevisiae is a diploid yeast, which, upon sporulation, usually yields four haploid ascospores. In our strain, the diploid is heterozygous for mating type, and mating type segregates 2:2 at meiosis. A diploid, heterozygous for mating type, but homozygous for adenine and uracil requirements, was crossed with haploids of both mating types (requiring tryptophan and methionine). The mixture of cells was plated on minimal agar lacking all four factors, as described by Pomper and Burkholder, for the isolation of heterozygous diploids. A few colonies appeared in heavily seeded plates. After isolation, these clones were induced to sporulate and asci were dissected which yielded four viable spores. Some of these spores could in turn be induced to sporulate, and it has been possible to carry out a complete genetic analysis of some asci. The evidence thus far obtained establishes that a cross occurred between a haploid and a heterozygous diploid to produce a triploid or its nuclear equivalent, and in some cases, at least, the triploid yields two diploid and two haploid ascospores. At the time of this writing, analysis of the segregations of the marker genes has not been completed. (Entire report. Abstract of paper for Boston meeting of the Soc. of Am. Bact., April 28-May 3, 1952.)

1592

Oak Ridge National Lab.

THE BIOCHEMICAL EFFECTS OF PLANT GROWTH REGULATORS (abstract), by G. R. Noggle. [nd] 2p. (AECU-1872)

The term "plant-growth regulator" is used to denote any organic compound which may regulate plant physiological processes while the term "auxin" is more specific and includes only those substances having in common the physiological characteristics of promoting elongation of cells, and a specific type of molecule. Following the discovery that indoleacetic acid was a naturally occurring plant auxin, a great deal of work was done on the physiological and biochemical effects of this compound on plants. This led to the synthesis of a great many homologs and analogs of indoleacetic acid and the discovery that many of these new compounds were powerful plant-growth regulators. The next phase of the work was concerned with attempts to discover the minimal structural requirements of a compound for primary auxin activity. Since there are many compounds which do not meet the requirements for auxin activity but are powerful growth regulators, attempts have also been made to assess the minimal structural requirements of these compounds. It appears likely that the basic action of the plant growth regulators is on some process of metabolism common to nearly all plant cells. There is a chain of events that may modify the actions of the plant growth regulator at the cellular level and these include such factors as degree of retention by the plant, penetration into the plant, and transport within the plant. Relatively little work has

been done at the cellular level of the biochemical effects of plant growth regulators. The following effects have been ascribed to the action of 2,4-D.

1. Increased cell proliferation
2. Increased respiration
3. Increased carbohydrate depletion
4. Decreased respiration by roots
5. Decreased uptake of K by roots
6. Decreased accumulation by root systems of KNO_3 and KCl
7. Inhibition of lipase activity
8. Inhibition of ascorbic acid oxidase
9. Stimulation of phosphatase activity
10. Stimulation of β-anylase activity

Just how much of the above activities is at the cellular level and not at some other level of action remains to be seen. There is a tremendous volume of critical work that remains to be done before this problem is solved. (Entire Report. Abstract of paper for Atlanta meeting of Southern Sec., American Soc. of Plant Physiologists, Feb. 5, 1952.)

RADIATION EFFECTS

1593

Naval Radiological Defense Lab.

EFFECT OF X-RADIATION, RADIOMIMETIC SUBSTANCES AND SURGICAL TRAUMA ON THE SULFHYDRYL CONTENT OF PLASMA; Final Report, by Bernard Shacter, Helen Supplee, and Cecil Entenman. Nov. 27, 1951. 22p. (AD-333(B); Technical Objective AW-6; U20409)

Plasma sulfhydryl concentrations (SC) were determined for 3- to 6-month-old rats of both sexes. Determinations were performed by amperometric titration with a rotating Pt electrode (TIP U16692); SC was estimated on both a protein and unit-volume basis. A Westinghouse x-ray-therapy unit was employed at 250 kvp and 25 r/min. Animals subjected to 700 r total-body x irradiation in a single exposure showed an SC decrease 2 days following irradiation. Lowest values were obtained 6 to 8 days after exposure when SC approximated 60% of control concentrations. By the twelfth day, SC values approached normal levels. A similarly delayed decrease, of lesser magnitude, was observed after intraperitoneal administration of N mustard and trisethylene triazine at a dose rate of 1 mg/kg body weight. Lowest values were obtained on the fifth day. No well-defined changes in SC were detected during a 6-day starvation period or after a single exposure to 300 r total-body x irradiation. Surgical trauma induced by laparotomy produced a significant SC decrease at 24 hr after injury, followed by a linear return to normal concentrations over a 12-day period. No significant changes occurred in the first 12 hr subsequent to laparotomy; no sex differences were observed. It is suggested that decreases in SC following tissue injury may be indicative of a markedly increased rate of utilization of sulfhydryl groups by regenerating tissue. (Presented in part at a meeting of the American Association for Cancer Research, Inc., April 1951.) (NRS abst.)

1594

Naval Radiological Defense Lab.

EFFECT OF X-RADIATION AND LAPAROTOMY ON THE POLYSACCHARIDE CONTENT OF PLASMA; RELATIONSHIP TO PLASMA SULFHYDRYL CHANGES; Final Report, by Bernard Shacter, Helen Supplee, and Cecil Entenman. Nov. 27, 1951. 11p. (AD-334(B); Technical Objective AW-6; U20432)

The nonglucosamine polysaccharide content (PC) of rat plasma was determined colorimetrically by the tryptophane method of Shetlar and others (Proc. Soc. Exptl. Biol. Med. 67, 125(1948)). Blood was collected in syringes moistened with 20% K oxalate. Male rats subjected to 700-r total-body x irradiation in a single exposure showed no PC change during the first 5 postirradiation days. PC levels rose significantly on the sixth day, remained elevated for a few days, and returned to normal by the twelfth day. Exposure to 300-r total-body x radiation had no effect on PC. Laparotomy resulted in a significant PC increase in 24 hr. Highest values, which were attained 1 to 2 days following laparotomy, returned gradually to normal. PC was consistently greater for male control and laparotomized rats than for the corresponding female animals. In general, sulfhydryl changes (TIP U20409) were detected sooner and lasted longer than the polysaccharide changes. It was tentatively concluded that the same conditions produce the 2 changes; however, the polysaccharide elevations may be less detectable by the methods employed. (NRS abst.)

1595

Brookhaven National Lab.

BIOLOGY AND MEDICINE, p.131-162 of QUARTERLY PROGRESS REPORT; JULY 1 - SEPTEMBER 30, 1951 (Unclassified Section). [nd] 32p. (BNL-132(p.131-162))

Progress is reported on a number of biological problems. Preliminary observations of cytological and morphological changes induced in plants by chronic γ irradiation are reported for plants grown in the 200-curie γ field. Data on weight changes and water consumption and metabolism of rats following x irradiation, histological changes in the pituitary of rats following irradiation, and the kinetics of phosphate interchange in tissues are included. Studies of uptake and distribution of Ba, La, Cu, and P by Drosophila are reported. Further studies of the effects of radiation upon nucleic acids in plants and animals and metabolism of nucleic acids are discussed. A decontamination unit for use in event of heavy contamination of personnel is described. Cl^{38} was found to reduce ascites in three patients with metastatic growths in the peritoneal cavity. The mechanism of this reaction is under investigation. Effects of radiation upon antibody production are being studied and preliminary data are included.

1596

Naval School of Aviation Medicine, Pensacola

FURTHER EVALUATION OF PRESENT DAY KNOWLEDGE OF COSMIC RADIATION IN TERMS OF THE HAZARD TO HEALTH, by Hermann J. Schaefer. Aug. 15, 1951. 23p. (NP-3564; U19329)

Data pertaining mainly to the heavy-nuclei component of the primary cosmic radiation and appearing in the literature between Jan. and Dec. 1950 are summarized. There are evidences that about 20% of the incoming primaries are atom nuclei of an atomic no. >1. Changes in the energy spectrum resulting from the geomagnetic fields at different latitudes are not accompanied by changes in the shape of the mass spectrum. The cut-off mechanism of the geomagnetic field which sets the lower limit of the energy spectrum of the primaries in dependence on the latitudes is discussed. The ionization peak and thin-down phenomena appear to be limited to the polar cap (geomagnetic latitudes of 55° and higher). The values of the specific ionization for the different components of the heavy spectrum cover a range from about 1000 ion pairs per 10 μ of living tissue to more than 1,000,000. The conversion factor for natural α rays (25,000 ion pairs per 10 μ) is 10; that for fission products (2.8 million ion pairs per 10 μ) is 27. Although no accurate interpolation for the different components of the heavy spectrum can be made, a first approximation seems possible on the assumption of a general conversion factor of 10. The exposure of humans to the primary cosmic radiation at extreme altitude is compared to the corresponding

exposures from incorporated radioactive substances. A 15-hr daily exposure continued over weeks and months is expected to produce marked symptons of radiation injury. A daily exposure of 1.3 hr is estimated to be about equal to the official tolerance limit of 0.1 γ Ra in the system. (NRS abst.)

1597

New York Univ.

EFFECT OF RADIOACTIVITY ON THE BIOCHEMICAL OXIDATION OF DOMESTIC SEWAGE; FINAL REPORT, by William E. Dobbins, Gail P. Edwards, Werner N. Grune, and Richard Ehrenreich. Oct. 1951. 84p. (NYO-1567)

This study has been devoted to the effect of P^{32} and I^{131} on the course of the biochemical oxidation of fresh domestic sewage. The results indicate that P^{32} exerts no measurable effect with initial activity levels of 0.1 and 1.0 mc/l but effects a very small reduction in the rate of oxygen utilization at the 10.0 mc/l level. The presence of I^{131} with initial activities of from 0.01 to 10.0 mc/l appears to produce a decrease in the rate of oxygen utilization, which results in a reduction in the total oxygen demand of about 10% by the seventh day. (auth)

1598

Oak Ridge National Lab.

THE PATHOGENESIS OF POSTIRRADIATION ANEMIA, by J. B. Kahn, Jr., and J. Furth. Issued Feb. 6, 1952. 34p. (ORNL-1186)

Irradiation at or below the median lethal dose does not hemolyze erythrocytes directly, but some change caused by massive irradiation results in increased destruction of erythrocytes. It is postulated that this change is a capillary endothelial damage causing diversion of erythrocytes into tissue spaces and lymphatics, resulting in injury of some erythrocytes. Thus, the anemia of irradiation is in part relative and in part absolute. The pathogenesis of this injury and the precise mechanism of erythrocyte destruction in massively irradiated hosts remain to be demonstrated. (auth)

1599

Oak Ridge National Lab.

CAPILLARY FRAGILITY CAUSED BY IONIZING RADIATIONS – CHANGES IN CELLULAR COMPOSITION OF THE LYMPH, by M. H. Ross, J. Furth, and R. R. Bigelow. Issued Feb. 8, 1952. 36p. (ORNL-1187)

Erythrocytes appear in large numbers in the lymph of rats and dogs after exposure to approximately an LD_{50} dose of x rays. The peak of endothelial fragility as indicated by the erythrocyte counts in the lymph is reached on the ninth to fourteenth day in rats and the eleventh to seventeenth day in dogs. In both species the erythrocyte count in the lymph frequently exceeds one million. Diversion of erythrocytes into the lymph compartment causes a relative anemia. Excessive destruction of erythrocytes, presumably related to extravasation and not to a direct irradiation injury, is responsible in part for the absolute anemia. The drop in lymphocyte counts in both lymph and blood is precipitous within 5 to 10 hr after irradiation. It is preceded by a transient rise in lymphocyte counts. During the fourth to eighth hour after irradiation, injured and dead lymphocytes are present in the lymph of rats in large numbers. During the recovery phase, the pér cent of large lymphocytes in the lymph greatly increases; there are many abnormal large lymphoid cells and mitotic figures; and tissue mast cells appear in the blood in small numbers. Diversion of erythrocytes into the lymph caused by massive irradiation, if severe, becomes a self-aggravating process and leads to death. (auth)

1600

Atomic Energy Project, Univ. of Calif., Los Angeles

IDENTIFICATION OF FERRITIN IN BLOOD OF DOGS SUBJECTED TO RADIATION FROM AN ATOMIC DETONATION, by Thomas J. Haley, M. R. Andem, Richard F. Riley, and I. Williams. Feb. 12, 1952. 10p. (UCLA-180)

Studies on blood plasma samples obtained from eight dogs subjected to a lethal dose of radiation from an atomic detonation demonstrated that a material was present which, when administered intravaneously, decreased the rate of vasomotion and decreased the epinephrine sensitivity of the mesoappendix capillary bed of the normal rat. After its appearance in the blood, the concentration of this vasodepressor material decreased as a function of time. This VDM has been shown to fit the criteria established for ferritin. (auth)

1601

THE LUMINESCENCE OF ISOLATED CHLOROPLASTS. Bernard L. Strehler. Arch. Biochem. Biophys. 34, 239-48 (1951) Dec.

The luminescence of isolated spinach and mustard chloroplasts has been studied under various conditions, using a quantum-counting photomultiplier at the temperature of liquid N. It has been found that luminescence and the Hill reaction rate, as determined by direct potentiometric measurement, saturate at nearly identical light intensities. Spinach chloroplasts show a temperature dependence for luminescence similar to that observed for Chlorella luminescence. Optimum activity was at ~36°C. The influence of pH on spinach and mustard chloroplast luminescence is characterized by two optima at ~pH 5 and ~pH 9. It is suggested that the initial reaction may have a broad pH optimum while a succeeding reaction may have a narrower optimum. The resulting interaction of the two systems would give the pH dependence curve observed. The decay curves for spinach chloroplast, spinach and mustard leaf, and Chlorella luminescence are very similar, approaching zero about 5 min after illumination. Mustard chloroplasts, on the other hand, show a low level of luminescence for as long as 35 min. Spinach and mustard chloroplasts, in contrast to Chlorella, show no induction phenomenon or effect of CO_2 on the level of luminescence. Inhibitors previously tested on Chlorella luminescence also showed some differences in their effect on spinach chloroplast luminescence. Hydroxylamine was more strongly inhibitory to spinach luminescence than to Chlorella luminescence while dinitrophenol, cyanide, and azide were appreciably less inhibitory. (auth)

1602

THE INACTIVATION OF CATALASE BY DEUTERONS AND HEAT. R. B. Setlow. Arch. Biochem. Biophys. 34, 396-408(1951) Dec.

The inactivation of beef red-cell catalase by fast deuterons, heat, and a combination of the two has been reported. The data have been analyzed quantitatively in terms of the target theory of ionizing radiation and the theory of absolute reaction rates. Evidence for the existence of at least two forms of stable catalase has been presented. The data are shown to indicate two possible alternative molecular weights (about 250,000 and 130,000) for catalase. (auth)

1603

BIOLOGICAL EFFECTS OF THE β RADIATION OF P^{32} ON B. COLI. A. Deysine and B. Bonet-Maury. Compt. rend. soc. biol. 145, 1091-3(1951) July. (In French)

B. coli in nutrient media containing 0.1 mc of P^{32}/ml was carried through seven generations. The decrease in number of living cells was observed in each generation for 150 days. Development of radioresistance in the later generations was noted. Increasing the P^{32} concentration to 1 mc/ml caused a much more rapid decrease in viability. No distinction in respiration rates could be found by the Warburg method between proliferating and inactivated cultures.

1604
RADIOIODINE AND HISTOPATHOLOGICAL EFFECTS. Roberts Rugh. J. Morphol. 89, 457-99(1951) Nov.

Histopathological effects on the thyroid glands of nursing adult mice and their suckling young, following the injection into the mother of NaI^{131} in doses ranging from 3 to 20 μc per gram of total body weight, at a time when the litter young were but three days of age, are discussed in detail. The thyroid gland of the mothers and their young were studied histologically at two months and at 10 weeks, following a single treatment with I^{131}. 55 references.

1605
UNIFIED THEORY OF THE MECHANISM OF ACTION OF X RADIATION. "REDUCING POWER" AND "SECONDARY CHEMICAL ACTION." Annibale Casati. Radiologia Med. 37, 1020-4(1951) Dec. (In Italian)

The mechanism of decomposition of chemical substances by x rays is discussed solely in relation to the ionizing action of the radiation. The secondary chemical action is considered to be the intermediate formation of unidentifiable and unrecoverable substances which react with less radiosensitive substances to give the observed results. Thus, an aqueous solution is considered to be a mixture of radiosensitive H_2O and insensitive solute. A discussion is given of the protective effect of a solute having great chemical affinity for the decomposition products of H_2O on the stability of the other solutes.

1606
HISTOLOGICAL EFFECTS OF LONG-CONTINUED WHOLE-BODY GAMMA-IRRADIATION OF MICE. B. Spargo, J. R. Bloomfield, D. J. Glotzer, E. Leiter Gordon, and O. Nichols. J. Natl. Cancer Inst. 12, 615-56(1951) Dec.

Chronic effects of repeated low doses of external γ radiation on mice sacrificed at bimonthly intervals from 2 to 16 mo are reported.

1607
THE 30-DAY LD-50 OF TWO RADIATIONS OF DIFFERENT ION DENSITY. Joanne Weikel Hollcroft and Egon Lorenz. J. Natl. Cancer Inst. 12, 533-44(1951) Dec.

The 30-day LD_{50} x radiation was compared with that of the α particles emanating from short-lived decay products of radon injected intravenously in strain A male mice. The integral dose of x radiation necessary to produce 50% death was found to be 1.42 times that of α particles. Regression curves are given. The distribution of short-lived decay products of radon was followed for the 2-hr period following injection. The distribution of the dose was calculated. (auth)

RADIATION HAZARDS AND PROTECTION

1608
Argonne National Lab.
GROWTH OF TUMOR FRAGMENTS X-IRRADIATED IN VITRO FOLLOWING PRETREATMENT WITH CYSTEINE, by B. Vincent Hall. Aug. 1951. University of Illinois and Argonne National Lab. 24p. (AECU-1866; UAC-500)

The data presented on the survival and growth of mouse tumor fragments following x irradiation in vitro with and without prior treatment with 0.008 M cysteine clearly demonstrate the prevention and alleviation of radiation injury of mammalian tumor cells by cysteine. The radiation dose that damaged untreated implants to the extent that only 50% grew when transplanted into host mice, had to be increased by nearly 20% or 569 r, to effect equivalent injury of cysteine-treated implants. Delay in initiation of growth by tumor fragments following implantation was increased by radiation effects, and the effect was found to bear roughly an exponential relation to the radiation dose. Intra- and intercellular cysteine rather than the cysteine of the ambient medium was found to be the effective agent in reducing the radiosensitivity of tumor fragments. It is suggested that the intracellular cysteine is most effective in preventing and alleviating the cellular response to ionizing radiation. 31 references. (auth)

1609
Argonne National Lab.
BONE CARBONATE TURNOVER, by Donald L. Buchanan and Akira Nakao. Jan. 1952. 31p. (AECU-1867; UAC-499)

The effects of age, growth, body size, duration of exposure, and ambient CO_2 concentration on bone carbonate turnover were studied in mice and rats. Results indicate that the carbonate of new bone forming in infant mice arises wholly or largely by incorporation of soluble inorganic C into the precipitating bone salt; approximately 30% of the carbonate in the bone of fully grown animals exchanges quite rapidly with the soluble carbonate system whereas approximately 40% exchanges very slowly; turnover rates in the adult are largely determined by the physical and chemical properties of bone salt; growth of bone stimulates the turnover of bone carbonate out of all proportion to the net increase in bone mass, and long term retention of isotopic carbonate in the entire skeleton of mice is approximately proportional to the duration of the exposure regardless of the age of the animal when exposed. On the basis of the data presented it was concluded that adult or growing mammals can exist continuously and indefinitely in an atmosphere which contains as much as 49 μc of $C^{14}O_2$ per cubic meter of air and yet never exceed a radiation dose rate to bone of 0.3 rep per week.

1610
Oak Ridge National Lab.
A METHOD FOR DECONTAMINATING SMALL VOLUMES OF RADIOACTIVE WATER, by R. A. Lauderdale and A. H. Emmons. [nd] 12p. (CF-51-3-130)

Data and descriptive material are presented describing the experimental results obtained with an apparatus designed to reduce the activity level of highly contaminated water. The unit described, consisting of a columnar arrangement of steel wool, clay, carbon and monobed exchange resin, is capable of reducing the activity level of water from 2.5 $\mu c/cc$ to less than 10^{-4} $\mu c/cc$. (auth)

1611
Chemical and Radiological Lab., Army Chemical Center
MAXIMUM ALLOWABLE CONCENTRATIONS OF FISSION PRODUCTS IN THE AIR AS A FUNCTION OF EXPOSURE TIME AND TIME AFTER DETONATION, by Robert L. Harvey. Nov. 9, 1951. 17p. (CRLIR-64; U20189)

Data from the literature on the maximum permissible fission-product concentration in the body, based on Sr^{90} activity, are summarized. The β activities and Sr concentration equivalents of 9 nuclides which constitute internal hazards are tabulated for 1, 12, and 24 hr and 1 to 10, 10 to 100, and 100 to 1000 days of exposure. Families of curves are presented relating the MPC in air (so that not more than 1 μc of equivalent Sr^{90} is retained in the body) to time after detonation for exposure times of 8 and 24 hr and 7 days. (NRS abst.)

1612
Oak Ridge National Lab.
PROTECTION EXPERIMENTS AGAINST RADIATION INJURY WITH LYMPHOCYTES, by Ira L. Campbell and Mary H. Ross. 7p. (ORNL-1193)

This experiment was undertaken to determine whether the injection of lymphocytes into irradiated animals would offer protection against the effects of radiation. The ex-

periments were so designed as to obtain living lymphocytes in their natural medium and introduce them into genetically compatible hosts. The results were essentially negative and are presented in some detail. (auth)

1613

PRACTICAL METHOD FOR THE MEASUREMENT AND CONTROL OF ANTI-X-RAY PROTECTION AND TOLERANCE DOSE BY MEANS OF PHOTOGRAPHIC FILM. Arturo Gilardoni. Radiologia Med. 37, 1025-7(1951) Dec. (In Italian)

The disadvantages of the usual use of film badges while performing individual experiments are the expensive and complex instruments necessary for densitometry of the exposed film. An inexpensive method using dental film and simple comparison of the blackening with that caused by known exposures is described.

RADIOTHERAPY

1614

RADIOACTIVE ARSENIC IN THE TREATMENT OF HODGKIN'S DISEASE AND FUNGOID MYCOSIS. Lucien Mallet, Georges Marchal, and Gérard Duhamel. Acta Haemat. 7, 27-38(1952) Jan. (In French)

As^{76} as oral Na arsenate solution has been used in divided doses of the order of 5-mc to treat skin diseases. In two cases of lymphogranulomatosis with cutaneous localization the cutaneous manifestations and pruritus disappeared. One of these patients still shows a complete remission after 15 months. Two patients in the terminal stage of mycosis fungoides showed under the treatment with As^{76} an improvement of the skin changes and survived for 4 and 6 months, respectively. Because of its 26.8-hr half life, As^{76} must be applied without delay. The most important disadvantage of the oral method is the frequency of gastrointestinal side-effects. The marked dermotropic fixation of As^{76} restricts the indications to the pruriginous and cutaneous forms of lymphogranulomatosis.

TOXICOLOGY STUDIES

1615

Argonne National Lab.

STUDIES ON THE MECHANISM OF PROTECTION BY AURINTRICARBOXYLIC ACID IN BERYLLIUM POISONING, by Jack Schubert, Marcia R. White, and Arthur Lindenbaum. Dec. 1951. 15p. (AECU-1841; UAC-491)

Aurintricarboxylic acid (ATA) had no effect on the distribution or excretion of Be^{7} injected with carrier $BeSO_4$ into mice, except to increase the amount of Be in the kidneys. Most of the C^{14}-labeled ATA injected intravenously into rats was found in the gastro-intestinal tract, excreta, and skin. The injection of $BeSO_4$ one hour prior to ATA increased the amount of ATA in only the kidneys and spleen. The injection of triphenylmethane dyes other than ATA (fluorescein, phenol red, and acid fuchsin), of alizarin red S, or of cupferron one hour after injection of the LD_{95} of Be into mice did not increase survival. Heat sterilization removed the capacity of solutions of the ammonium salt of ATA to protect mice acutely poisoned with Be but had no effect on the effectiveness of solutions of the sodium salt of ATA. It is postulated that the protective action of ATA in Be poisoning involves a combination of chelate formation between Be and the orth-carboxyl, hydroxyl groupings in the ATA molecule with conversion to a nondiffusible colloidal aggregate—a lake. (auth)

1616

Argonne National Lab.

EFFECT OF AURIN TRICARBOXYLIC ACID ON BERYLLIUM INHIBITION OF ALKALINE PHOSPHATASE, by Arthur Lindenbaum, Marcia R. White, and Jack Schubert, Dec. 1951. 17p. (AECU-1850; UAC-490)

Aurin tricarboxylic acid (ATA) reversed the inhibition of plasma alkaline phosphatase induced by beryllium, both in vitro and in vivo, in rats when the molar ratio of ATA to Be was greater than 1. Maximum reversal was obtained when the molar ratio was about 15. Plasma alkaline phosphatase was inhibited in vivo by as little as 0.01 mg of Be per kg. Between 0.2 and 0.8 mg of Be per kg produced maximum inhibition (about 78%) within 15 min, after which the activity gradually returned to normal within 12 to 48 hr. These amounts of Be had no effect upon the alkaline phosphatase of liver and spleen homogenates. ATA itself inhibited the alkaline phosphatase of liver, spleen, and plasma. It is concluded that the experimental data are consistent with the postulate of lake formation as the mechanism by which ATA exerts its protective effect against acute Be toxicity. (auth)

1617

California Univ. School of Medicine

THE NUTRITIONAL VALUE OF INTRAVENOUS TAPIOCA DEXTRIN IN NORMAL AND IRRADIATED RABBITS, by Lawrence E. Detrick, Alvin E. Lewis, Thomas J. Haley, and Bonnie Rhodes. Issued Jan. 23, 1952. 16p. (UCLA-181)

Experiments with rabbits led to the following conclusions: An intravenously injected tapioca dextrin is not a source of high caloric value. A parenteral solution of tapioca dextrin, amino acid hydrolysate and vitamins, when intravenously injected at a rate of 25 cc per hour, in two 3-hour injection periods with a 1 hour rest period intervening, and in daily doses of 150 cc is well tolerated by the majority of normal rabbits for eleven consecutive days. The histological kidney damage observed after eleven daily injections of parenteral tapioca dextrin is reversible during the oral fed recovery period. Acute whole body irradiation increased the sensitivity and the mortality rate of rabbits fed intravenous tapioca dextrin. Irradiated rabbits, fed orally, survived longer than those receiving intravenous alimentation. A satisfactory technique was developed for chronic toxicity studies of the blood plasma volume substitutes. (auth)

TRACER APPLICATIONS

1618

Kedzie Chemical Lab., Mich. State Coll.

THE ORIGIN OF THE METHYL CARBON OF NICOTINE FORMED BY NICOTIANA RUSTICA L, by Stewart A. Brown and Richard U. Byerrum. [nd] 14p. (AECU-1858)

Tracer experiments with C^{14} have established that the methyl carbon of methionine can act as a precursor of the nicotine methyl carbon in intact Nicotiana rustica plants. A lesser incorporation of formate carbon into the methyl group of nicotine was observed. It is considered probable that formate is employed by the plant in the synthesis of labile methyl groups, which then undergo transmethylation to nicotine. Possible applications of methyl-labeled nicotine in plant biochemistry and pharmacology are discussed.

1619

ETHANOL FORMATION IN PSEUDOMONAS LINDNERI. Martin Gibbs and Ralph D. DeMoss. Arch. Biochem. Biophys. 34, 478-9(1951) Dec.

An investigation of C^{14}-glucose fermentation by Pseudomonas lindneri showed glucose to yield two molecules of ethanol, each derived via a different pathway. The anaerobic Zwischenferment shunt catalyzed the conversion of glucose 6-phosphate to CO_2 (C-1) and a pentose phosphate followed by a C_2-C_3 cleavage of the latter. The C_2-fragment (C-2 and

C-3 of glucose) precursed one of the ethanol molecules while the C_3 moiety, presumably triose phosphate, was then converted to pyruvate by the usual enzyme system. Carboxylase then catalyzed the simple decarboxylation of pyruvate to CO_2 (carbon atom C-4 of glucose) and acetaldehyde; the latter was subsequently reduced to ethanol (C-5 and C-6 of glucose).

1620
CONVERSION OF α-KETOGLUTARIC-1,2-C_2^{14} ACID TO MALIC ACID IN PIGEON BREAST MUSCLE. E. H. Mosbach, E. F. Phares, and S. F. Carson. Arch. Biochem. Biophys. 34, 449-52(1951) Dec.

Conversion of C^{14}-labeled α-ketoglutarate to malate was tested with a pigeon breast muscle preparation. Complete randomization between the labeled carboxyl groups of the C_4-acids occurred during one pass from α-ketoglutarate to malate. (auth)

1621
LABELED ATOMS IN THE STUDY OF LIVING PLANTS. V. V. Rachinskiĭ. Uspekhi Sovremennoĭ Biol. 31, No. 3, 376-90(1951). (In Russian)

A short review of tracer techniques in botanical studies is presented. Included is a brief discussion of the use of tracers in Michurin genetics. 74 references.

1622
URINARY EXCRETION OF RADIOSODIUM BY THE RAT. LIBERATION OF ANTIDIURETIC HORMONE BY INJECTION OF SALINE SOLUTIONS. F. Morel. Compt. rend. soc. biol. 145, 677-80(1951) May. (In French)

Regulation of water metabolism in the rat by liberation of the antidiuretic post-pituitary hormone has been studied by injection of Na^{24}-labeled NaCl solutions, surgical immobilization of the pituitary, and injection of pituitary extract. Antidiuretic response to Na_2CO_3 and NH_4Cl also has been observed. The results are compared with similar observations on the dog by Verney (Proc. Roy. Soc.(London) 135B, 25(1947))

1623
URINARY EXCRETION OF SALT DURING WATER-INDUCED DIURESIS AS STUDIED IN THE RAT WITH RADIOSODIUM. François Morel. J. physiol. et path. gén. 43, 263-79(1951). (In French)

The course of the diuretic response of the rat to intravenous injection of H_2O has been studied with tracer Na^{24}. The apparatus is diagramed, and results are plotted. A direct action of post-pituitary hormone on H_2O absorption and Na excretion is suggested.

CHEMISTRY

AEROSOLS

1624
Aeronautical Research Consultative Committee (Australia)
CORROSION OF METALS; METALS UNDER STRESS; I. ALUMINIUM, by P. F. Thompson. July 1950. 22p. (ACA-49)

Research was undertaken to assess the electrochemical processes in terms of their intensity factors. The chief of these is the potential difference between the anodic and cathodic surfaces of the particular corrosion cell involved. The measurement of this involved the comparison of the potential of the surface under examination with that of the standard electrode, in most cases the saturated calomel half cell. To detect differential effects, the potential of a micro-electrode of the Al was measured at the same time as that of the specimen under stress while a platinum micro-electrode gave the oxidizing potential of the liquid. The pH value of the liquid could be determined by the glass electrode if necessary. Determinations were made in various liquids, including distilled water, tap water, salt solutions and sea water, so that the full assessment of the oxidizing potentials could be made.

1625
Oak Ridge National Lab.
CHEMISTRY OF THORIUM IN AQUEOUS SOLUTIONS. II. CHLORIDE COMPLEXING AS A FUNCTION OF IONIC STRENGTH, by W. C. Waggener and R. W. Stoughton. [nd] Decl. Apr. 23, 1951. 18p. (AECD-3305; ORNL-1001)

Chloride complexing of aqueous Th has been studied as a function of ionic strength over the range 0.5 to 6.0 using the TTA (thenoyltrifluoroacetone)-benzene solvent-extraction method. Chloride data up to 4M are explained in terms of successive complexing, and constants are estimated for formation of $ThCl^{+3}$, $ThCl_2^{++}$, $ThCl_3^{+}$, and $ThCl_4$. Aqueous TTA-Th species have been investigated by a new method: measuring the partition of TTA, under suitable conditions, between a benzene phase and an aqueous phase, as a function of both Th and chloride concentration. A single complex, mono(thenoyltrifluoroacetone)-Th (i.e., ThT^{+3}), has been found, and a tentative value for K_T ($Th^{+4} + HT_{aq} = ThT^{+3} + H^+$) at $\mu = 2.00$ is $6.6 \pm 5\%$. There is no evidence for a double complex involving both TTA and chloride. (auth)

1626
Oregon State Coll.
ISOTOPIC EXCHANGE REACTIONS IN ACETIC ACID AND ACETIC ANHYDRIDE, by Ersel A. Evans, J. L. Huston, and T. H. Norris. [nd] 25p. (AECU-1845)

Rapid exchange occurs between radiocarbon-labeled sodium acetate and solvent acetic acid. This is explained in terms of direct transfer of protons from acetic acid molecules to acetate ions, rather than by self-ionization of acetic acid. Rapid exchange also occurs between acetic acid and dissolved plumbic acetate and plumbous acetate, as well as between acetic anhydride and dissolved plumbic acetate; these are explained by mechanisms similar to that for sodium acetate in acetic acid and also by formation of complexes. Slow exchange occurs between acetic acid and acetic anhydride showing that the self-ionization of both, to give acetate ions, cannot be fast. Slow exchange occurs between acetic anhydride and dissolved acetyl chloride, which is taken to indicate slow ionization of the latter. Appreciable heterogeneous exchange takes place between solid sodium acetate and acetic anhydride, but much less than previously reported. The results of all these experiments are in general interpreted to indicate there has been an over-emphasis on ionic mechanisms and analogies to the water system by the proponents of the solvent system of acids and bases. No electronic exchange takes place between plumbic acetate and plumbous acetate, dissolved in pure acetic acid for four hours at 80°. This is contrary to results previously reported by other workers. (auth)

1627
Bureau of Mines
EXPLOSIVE CHARACTERISTICS OF TITANIUM, ZIRCONIUM, THORIUM, URANIUM AND THEIR HYDRIDES, by Irving Hartmann, John Nagy, and Murray Jacobson. Dec. 1951. 54p. (BM-RI-4835)

Experimental results are given on 22 samples of Ti, Zr, Th, and U powders and on the hydrides of the metals. The tests were performed to determine the ease of ignition and the various factors that influence the explosion hazards. Test equipment and procedures are outlined.

1628

Brookhaven National Lab.

CHEMISTRY AND REACTOR SCIENCE AND ENGINEERING, p.65-130 of QUARTERLY PROGRESS REPORT; JULY 1 - SEPTEMBER 30, 1951 (Unclassified Section). [nd] 66p. (BNL-132(p.65-130))

The report of progress by the Chemistry Department contains 17 individual reports of research in the fields of radiation chemistry, isotopic tracer studies, low-temperature optical spectroscopy, radiochemistry, mass spectroscopy and neutron diffraction, many of which represent contributions for publication in the open literature. The report of progress of the Reactor Science and Engineering Department summarizes work done in the fields of fission product utilization and concentration, permanent radioactive waste disposal, radioisotopes separation, cross-section and other measurements with the crystal neutron spectrometer, the double beta-decay cloud chamber, and some development work of the department.

1629

Ames Lab.

THE ACIDITY CONSTANT, SOLUBILITY PRODUCT, AND SOLUBILITY OF DITHIOOXAMIDE, by Ruth Powers Yaffe and Adolf F. Voigt. Feb. 1, 1952. 3p. (ISC-206)

The acidity constant of dithiooxamide was determined by a potentiometric titration procedure. The solubility product and the solubility were calculated from these data. Results of five titrations are tabulated. It was found that dithiooxamide behaved as a monobasic acid.

1630

Knolls Atomic Power Lab.

SODIUM-AIR REACTION EXPERIMENTS, by C. O. Nelson and D. B. Nelson. Jan. 1, 1952. 15p. (KAPL-639)

A series of test setups were made in which visual observations of "sparking," "glowing," or "flash flame" were used as the criteria of combustion. Preheated sodium charges were violently discharged into a chamber containing a controlled atmosphere. Initial sampling and/or control of the oxygen content of the atmosphere plus observations as to relative humidity were made. In some cases, analysis of the oxygen content of the products of combustion was also made. Results by range of initial oxygen content were as follows: O to 5% O_2, no visual combustion; 5 to 10% O_2, sparking only in cases of very fine dispersal; 10 to 15% O_2, prompt combustion to be anticipated in most cases. (auth)

1631

Pennsylvania State Coll.

STUDIES ON COORDINATION COMPOUNDS. I. A METHOI FOR DETERMINING THERMODYNAMIC EQUILIBRIUM CONSTANTS IN MIXED SOLVENTS, by LeGrand G. Van Uitert and Charles G. Haas. Nov. 16, 1951. 16p. (NYO-729)

In the past "pH" titrations in partially nonaqueous solvents have been made in order to determine the stability of coordination compounds. The interpretation of such data has been reconsidered with the object of obtaining thermodynamic stability constants. It is assumed that the activity coefficient of electrolytic solutes in these solvents is determined solely by the solvent composition and the ionic concentrations. Experimental substantiation of the assumption is given, and the method of calculating thermodynamic stability constants is discussed. The systems studied were HCl – NaCl, acetic acid, and propionic acid in water-dioxane solution.

1632

Pittsburgh Univ.

STRUCTURE AND BEHAVIOR OF ORGANIC ANALYTICAL REAGENTS. III. STABILITY OF CHELATES OF 8-HYDROXYQUINOLINE AND ANALOGOUS REAGENTS, by William Dwight Johnston and Henry Freiser. Dec. 26, 1951. 26p. (NYO-3066)

Stabilities of chelates of 8-hydroxyquinoline and several analogous reagents have been determined for a representative group of common divalent metals in order to determine the effect of certain structural changes on chelate stability. It has been shown that any substituent in the 2-position of 8-hydroxyquinoline prevents the reagent from reacting with Al(III). This was presumably due to steric hindrance between the three organic molecules around the small al(III) ion. Stability measurements made on a series of chelates of 8-hydroxyquinaldine show that significant hindrance is also encountered in the cases of Ni(II) and Cu(II). A study of the stabilities of chelates of 2-(o-hydroxyphenyl)quinoline and 1-(o-hydroxyphenyl)isoquinoline was undertaken in order to evaluate the effect of ring size on chelate stability. The lack of reactivity of 2-(o-hydroxyphenyl)quinoline with divalent metals and the relatively low stability of chelates of 1-(o-hydroxyphenyl)isoquinoline indicate that for this type of reagent five-membered ring chelates are more stable than chelates having six-membered rings. The divalent metal stability sequence of 8-hydroxyquinoline chelates is in agreement with reported metal orders for other chelating reagents. This order for the transition metals shows an increase in chelate stability as the transition electron shell becomes more completely filled. A similar effect has been noted in the case of La(III) and Ce(III) of the inner transition metals. (auth)

1633

Pennsylvania State Coll.

STUDIES ON COORDINATION COMPOUNDS. II. THE DISSOCIATION CONSTANTS OF BETA-DIKETONES IN WATER-DIOXANE SOLUTIONS, by LeGrand G. Van Uitert, Charles G. Haas, W. Conard Fernelius, and Bodie E. Douglas. Jan. 12, 1952. 12p. (NYO-3367)

The variation of the pK_D values for several β-diketones with changes in composition of water-dioxane solutions has been found to follow the general pattern for simple acids above a mole fraction of dioxane (n_2) of 0.10. Shifts in the keto-enol equilibrium cause deviations from linearity below $n_2 = 0.10$ for some compounds studied. A comparison has been made of the effect of various end-groups on the acid strength of the β-diketones and their tendency to coordinate with the Na ion. (auth)

1634

Pennsylvania State Coll.

STUDIES OF COORDINATION COMPOUNDS. III. THE CHELATING TENDENCIES OF BETA-DIKETONES WITH THE CHLORIDES OF COPPER(II), NICKEL AND BARIUM IN WATER-DIOXANE SOLUTIONS, by LeGrand G. Van Uitert, W. Conard Fernelius, and Bodie E. Douglas. Jan. 14, 1952. 16p. (NYO-3368)

The variation of the logarithms of the formation constants (K_f) of the coordination compounds of Cu, Ni, and Ba with structurally similar β-diketones (HCh) has been found to be an essentially linear function of the negative logarithms of the acid dissociation constants (pK_D) of the β-diketones. The β-diketones that have two aromatic rings as end-groups form more stable chelate compounds than those with aliphatic end-groups for comparable pK_D values. The slopes of the pK_D vs. log K_f lines increase with an increase in the chelating ability of the metal ions involved. Ni compounds having the composition $NaNiCh_3.C_4H_8O_2$ are precipitated from the water-dioxane solutions used. The trifluoromethyl and Si-containing β-diketones hydrolyze under the conditions employed in these titrations. (auth)

1635

Louisiana State Univ.

POLAROGRAPHIC STUDY OF THE KINETICS OF IONIC

RECOMBINATION AND COMPARISON WITH ONSAGER'S THEORY, by Paul Delahay and Thomas J. Adams. Sept. 1951. 19p. (NP-3578; Technical Report No. 2; U20200)

Theoretical results on ionic recombination are compared with corresponding experimental data obtained from the observation of kinetic waves in the reduction of $CH_3COCOOH$. An equation for the rate constant of processes involving the recombination of 2 univalent ions (C^+ and A^- which combine to form molecule CA) is derived from Onsager's theory (J. Chem. Phys. 2, 599(1934)). The temperature coefficient obtained was essentially the same as for a diffusion process. The theoretical results compared satisfactorily with polarographic data for the recombination of pyruvate and H ions if the perturbation caused by the electrical field at the Hg drop is taken into account. Results of experiments to determine the dependence of the rate constant on ionic strength are analyzed on the basis of the Debye-Hückel theory. The influence of the rate of electrode process in polarographic studies of ionic recombination is discussed quantitatively. (cf. TIP U20199) (NRS abst.)

1636

Wisconsin Univ.

THE CHEMISTRY OF ZIRCONIUM AND HAFNIUM; FOURTH QUARTERLY REPORT; NOVEMBER 1, 1950–JANUARY 31, 1951. [nd] 16p. (NP-3584)

When a large excess of phosphorus oxyhalogen was added to $ZrCl_4$ and $HfCl_4$, gain in weight studies and analyses showed that addition compounds were formed. If the period of time during which the MCl_4 and $POFCl_2$ or POF_2Cl were in contact was extended, a disproportionation was observed with the POF_2Cl disproportionating more rapidly than the $POFCl_2$. Results of thermal-decomposition studies of the addition compounds are tabulated. Studies of the behavior of Zr and Hf on ion-exchange resins showed that establishment of equilibrium required about 72 hr. A decrease in the distribution coefficient at concentrations above 2.45×10^{-4} M was interpreted to mean that polymers began to form at the concentration and that the polymers did not go on to the resin. The melting points and densities of Hf and Zr derivatives of six β diketones and the distribution coefficients of Zr and Hf between water and diketone solutions of benzene are tabulated. Studies of the selenite method of Hf-Zr analysis indicate that the presence of a solubilizing ion is required for conversion of the basic selenite to a dense, hard precipitate. Incomplete removal of Se may account for high results obtained in initial analyses.

1637

Institute for the Study of Rate Processes, Univ. of Utah

SOME ASPECTS OF CATALYTIC HYDROGENATION; III. ETHYLENE, by Charles B. Colburn, Merrill B. Wallenstein, Ransom B. Parlin, and Bruno J. Zwolinski. Dec. 1, 1951. (NP-3587; Technical Report No. VIII)

The general equation for hydrogenation as derived previously is

$$\frac{dp_3}{dt} = \frac{k K_1 K_2 p_1 p_2}{[1 + K_1 p_1 + K_2 p_2]^2}$$

where the subscripts 1, 2, and 3 refer to ethylene, hydrogen, and ethane, respectively, k is the rate constant for reaction between adsorbed hydrogen and adsorbed ethylene, the K's are the equilibrium constants for the adsorption of ethylene and hydrogen, and the p's are the pressures of the respective gases. This equation is found to be applicable over a wide range of temperatures and pressures. The same equation is found upon assumption of several possible rate-determining steps, i.e., combination of adsorbed ethylene and hydrogen, or desorption of ethane following its formation from adsorbed ethylene and hydrogen. The possibility is presented that the decrease in apparent temperature coefficient in the process with increasing temperature is due to a change in the nature of the catalytic surface.

1638

Pennsylvania State Coll.

POLAROGRAPHIC BEHAVIOR OF ORGANIC COMPOUNDS. XV. EFFECT OF IONIC STRENGTH AND BUFFER NATURE ON QUINHYDRONE, by Philip J. Elving and Aaron J. Martin. Aug. 25, 1951. 19p. (NYO-848; Report No. 10)

Values of $E_{1/2}$ for the quinhydrone system in McIlvaine and Walpole buffers become more positive or remain constant as concentration of the buffer increases, but become more negative when ionic strength is increased at constant buffer concentration. These shifts are correlated with changes in the activity coefficients and diffusion constants of quinone and hydroquinone. At low buffer concentration, the value of n, as determined from the slope of the polarogram, increases with an increase in the buffer concentration. This change is indicative of reversibility and reflects the divergence between the $E_{1/2}$ values of quinone and hydroquinone that is produced by inadequate buffering. The present work is compared with similar studies on irreversible systems. (auth)

1639

Pennsylvania State Coll.

POLAROGRAPHIC BEHAVIOR OF ORGANIC COMPOUNDS. XVI. EFFECT OF pH, IONIC STRENGTH AND BUFFER NATURE ON A NON-IONIZABLE SUBSTANCE, by Philip J. Elving, Ching-siang Tang, and Isadore Rosenthal. Sept. 15, 1951. 7p. (NYO-849; Report No. 11)

A study of the effect of ionic strength, buffer nature, and pH on the polarographic behavior of ethyl monobromoacetate shows that the reduction of the carbon-halogen bond is pH-independent. The reversal of ionic strength effects found previously with the free acid are connected with the dissociation of the acid, rather than with the actual carbon-halogen bond fission. (auth)

1640

Pennsylvania State Coll.

POLAROGRAPHIC BEHAVIOR OF ORGANIC COMPOUNDS. XVII. THE ETHYL ESTERS OF THE BROMOACETIC ACIDS, by Ching-siang Tang and Philip J. Elving. Oct. 10, 1951. 7p. (NYO-851; Report No. 13)

The three ethyl bromoacetates were studied polarographically and the effect of pH and temperature evaluated. The half-wave potentials for fission of the various carbon-halogen bonds were found to be pH-independent, and in all cases the bonds in the ester were more easily reduced than the corresponding bonds in the acid. The nature of the relationship among wave heights in the step-wise removal of halogens is considered. (auth)

1641

Radiation Lab., Univ. of Calif.

SOME PROBLEMS IN THE CHEMISTRY OF GERMANIUM (thesis), by W. L. Jolly. Jan. 1952. 87p. (UCRL-1638)

An investigation was undertaken to obtain some quantitative relationships among various inorganic compounds, and, through the application of simple thermodynamics, to evaluate the free energies of typical compounds in the +2 and +4 oxidation states. The following experimental techniques are discussed: heat of oxidation of GeI_2, disproportionation of GeI_2, GeO-GeO_2 electrode, solubility of $Ge(OH)_2$, vapor pressure, heat of formation, and x-ray pattern of GeO, HCl-GeO_2 equilibrium, heat of oxidation of Ge, absorption, and Raman spectea of GeI_4.

1642

NITRIDATION OF NIOBIUM. Albert Septier, Maurice Gauzit, and Pierre Baruch. Compt. rend. 234, 105-7(1952) Jan. 2. (In Fren

Nb nitride has been prepared by heating 0.25-mm-diam Nb wires in NH_3 for 20 min at 1200°C, 30 min at 1450°C, and 40 min at 1400°C. All of the specimens were superconductive at liquid-H_2 temperature. Composition of cross sections of the wires was studied with an electron-emission microscope. In addition to the known NbN, a second phase attributed to the subnitride Nb_2N was observed. 3 figures.

1643

INFORMATION ON LITHIUM IMIDE. Robert Juza and Karl Opp. Z. anorg. u. allgem. Chem. 266, 325-30(1951) Nov. (In German)

Li_2NH has been prepared by thermal decomposition of the amide. Its density is 1.48, and it crystallizes as an isomorph of Li_2O and an antiisomorph of CaF_2. The space group is O_h^5, and the lattice constant is 5.047 A. The Li^+-NH_2^{--} distance is 2.19 A, giving a univalent radius of 2.00 A for the NH_2^{--} ion. Tensimeter measurements show that Li amide does not form an ammoniate. The thermally decomposing $LiNH_2$ first evolves NH_3, then transforms into two phases, an NH_3-poor amide mixed crystal and Li_2NH.

1644

THE SHORT-WAVE BANDS OF THE V^{+3} COMPLEXES. Hermann Hartmann. Z. Naturforsch. 6a, 781(1951) Dec. (In German)

Since the V—O band distance in the complex ions $[V(H_2O)_6]^{+3}$ and $[V(alcohol)_6]^{+3}$ is very similar and the difference in ionization energy between H_2O and ethanol is 1.9 ev, this value should appear as the energy difference between the steep portions of the optical short-wave absorption spectra of the complexes. The measured value of the latter difference was 1.85 ev.

1645

ON THE ABSORPTION SPECTRA OF ELECTROSTATIC COMPLEX IONS OF TRIVALENT TRANSITION ELEMENTS WITH OCTAHEDRAL SYMMETRY. Hermann Hartmann and and Hans Ludwig Schläfer. Z. Naturforsch. 6a, 760-3(1951) Dec. (In German)

The visible absorption spectra of the magnetically normal octahedral complex ions $[XA_6]^{+3}$, where X = trivalent Ti, V, Cr, Mn, and Fe, and A = H_2O, CH_3OH, C_2H_5OH, and iso-C_4H_9OH, are explained by assuming that the weak long-wave (red-end) bands originate through transitions between the products of ground-term splitting arising from interaction with the electrostatic field of the ligands.

1646

ON THE CRITICAL STATE OF NORMAL FLUIDS. Louis Goldstein. Phys. Rev. 85, 35-7(1952) Jan. 1.

It is shown, within the framework of the correlation liquid model that in the space of relative momenta normal liquids have a distribution which leads to a condensation in this momentum space at the approach of their critical state. Other states do not exhibit this condensation process. (auth)

1647

ON ABSORPTION OF LIGHT BY COMPLEX IONS OF TRIVALENT VANADIUM WITH OCTAHEDRAL SYMMETRY. Hermann Hartmann and Hans Ludwig Schläfer. Z. Naturforsch. 6a, 754-9(1951) Dec. (In German)

The visible and ultraviolet absorption spectra of a series of solutions of complex ions of trivalent V of the type $[VA_6]^{+3}$, where A is H_2O, CH_3OH, C_2H_5OH, and iso-C_4H_9OH, have been measured. Also studied were the absorption spectra of crystalline $NH_4V(SO_4)_2 \cdot 12H_2O$ and $CsV(SO_4)_2 \cdot 12H_2O$. Intensity ratios and spectral positions of the long-wave (red end) bands are in good agreement with theory for the case of a central ion with two d electrons in O_h symmetry with the complex field.

ANALYTICAL PROCEDURES

1648

[Oak Ridge National Lab.]

SEPARATIONS WITH A MICRO MERCURY CATHODE, by Richard B. Hahn. Dec. 29, 1951. Decl. Feb. 4, 1952. 7p. (AECD-3300; CF-51-12-184)

Construction and use of an electrolysis cell employing a rigid 5-mil Ag foil plated with liquid Hg as cathode is described. The cell is 10 cm in length and 1.5 cm in diameter; the Ag cathode, spot-welded to a Pt wire, is 2 cm long and bent into a semicircular shape. Hg is applied to the surface by electrolysis of a 10% solution of $Hg_2(NO_3)_2$ containing a few drops of HNO_3. During electrolysis of a solution, stirring is accomplished by evolution of gases. The efficiency of the micro Hg cathode was tested by removing Fe and/or Cu from solutions of Al, U, and Zr ions. The separations were as effective as with conventional Hg electrodes. Electrodes of Cu, Pb, and pure Pt were tested but were not as satisfactory as Ag.

1649

Oak Ridge National Lab.

POTENTIOMETRIC TITRATION OF MILLIGRAM QUANTITIES OF URANIUM IN THE PRESENCE OF IRON, by Richard B. Hahn and Myron T. Kelley. Dec. 29, 1951. Decl. Feb. 1, 1952. 7p. (AECD-3311; CF-51-12-183)

The reduction of mg quantities of U(VI) with a slight excess of chromous sulfate followed by a potentiometric titration of the U(IV) with standard ceric sulfate in an atmosphere of CO_2 has been employed successfully in this laboratory. This method cannot be used in the presence of Fe at room temperatures, however, since the iron is reduced to Fe(II) and titrated along with the U. This interference can be overcome at room temperatures by complexing the Fe(II) with 1,10-phenanthroline. A precision and accuracy of about 1% can be obtained with samples containing only U and Fe as metallic constituents. Other nonreducible cations (U, Ni, etc.) do not interfere, although their presence may cause a slight decrease in the accuracy of the method. The method does not work successfully for the analysis of samples containing much more than 1 mg of Fe, even if a correspondingly larger amount of 1,10-phenanthroline is added.

1650

Oregon State Coll.

RADIOCARBON COMBUSTION AND MOUNTING TECHNIQUES, by Ersel A. Evans and J. L. Huston. [nd] 6p. (AECU-1843)

A wet-combustion apparatus was designed to eliminate the blanks due to CO_2 absorption from the air and sulfur trioxide from the Van Slyke-Folch oxidizing mixture. The apparatus permits absorption in vacuo and redistillation of CO_2. Chromic anhydride is used instead of chromium trioxide in the oxidizing mixture. A diagram is included of a device for mounting small samples of $BaCO_3$ for radioassay. The device is assembled and a few drops of a dilute suspension of $BaCO_3$ are placed on the planchet and centrifuged in a desk-top model centrifuge until the ether-alcohol mixture is evaporated.

1651

Los Alamos Scientific Lab.

POLAROGRAPHY OF ETHYLENEDIAMINE TETRAACETATE COMPLEXES OF EUROPIUM, by E. I. Onstott. [nd] 18p. (AECU-1864; LADC-1078)

Polarographic analysis of Eu complexes showed that in the presence of large excess of anions of ethylenediamine tetraacetic acid, Eu(III) is reversibly reduced to Eu(II) at the dropping mercury electrode in the pH range of 6 to 13.6. Data on complex ions identified are given and the ratios of dissociation constants for several of the ions calculated.

1652
Brookhaven National Lab.
DETERMINATION OF POLYGLUCOSE IN BLOOD AND URINE, by Donald D. Van Slyke and F. Marott Sinex. [nd] 20p. (BNL-1026)

Polyglucose is a water-soluble polymer of glucose prepared by chemical polymerization. Preparations with molecular weights ranging from 3000 to 160,000 have been obtained. Animal experiments have indicated that solutions are nontoxic and may have value for use as a blood substitute in treatment of shock. Two reactions of polyglucose have been studied. One is that with anthrone, which produces a green color adaptable to photometry with apparently all carbohydrates. The reagents and procedure are simple. The color intensity produced per unit of carbon has been found by experiments with solutions standardized by carbon determination to be the same whether the glucose is free or combined in polyglucose. The other reaction is the increase in reducing sugar caused by acid hydrolysis. Polyglucose has some reducing power, but it is greatly increased by hydrolysis.

1653
Ames Lab.
SPECTROPHOTOMETRIC INVESTIGATIONS OF SOME COMPLEXES OF RUTHENIUM III. THE RUTHENIUM-DITHIOOXAMIDE SYSTEM, by Ruth Powers Yaffe and Adolf F. Voigt. Feb. 5, 1952. 12p. (ISC-207)

The Ru(IV)-dithiooxamide system has been studied spectrophotometrically. It was found that both Ru(III) and RU(IV) form the same blue-green complexes, $Ru[SC(NH)CSNH_2]^{+2}$ and $Ru[SC(NH)CSNH_2]_3$. The formation constants of these complexes were evaluated at unit ionic strength. The reaction of Ru(III) and Ru(IV) with dithiooxamide in acetic acid to form a blue-green color has been developed into a colorimetric method for the analysis of Ru. Although the reaction has been used in a colorimetric procedure, none of the investigators has reported any study of the nature of the reaction to determine the formulae and stability constants of the complexes involved. Preliminary investigation of the Ru-dithiooxamide reaction suggested that, as in the thiocyanate and thiourea reaction, the Ru(IV) was being reduced to Ru(III) at the expense of the complexing agent. Therefore the method of interpretation of spectrophotometric data was that presented in the previous papers. (auth)

1654
Pittsburgh Univ.
2-(o-HYDROXPHENYL)-BENZOXAZOLE AS A REAGENT FOR THE DETERMINATION OF CADMIUM, by Joseph L. Walter and Henry Freiser. Issued Dec. 13, 1951. 12p. (NYO-739)

A method is described for a gravimetric determination of Cd based on the application of its reaction with 2-(o-hydroxyphenyl)-benzoxazole. It was found possible to determine from 1 to 80 mg of Cd to an average accuracy of 0.3 mg. By carrying out the precipitation at a pH of 10.5 in a tartrate buffer, virtually all interferences are removed. Of those ions studied only Ni and Co interfere seriously. Cd may be determined in the presence of Cu by precipitating the latter with the reagent at a lower pH. (auth)

1655
Princeton Univ.
STUDIES IN FLAME PHOTOMETRY; THE DETERMINATION OF BORON, by C. E. Bricker, W. A. Dippel, and N. H. Furman. Dec. 31, 1951. 9p. (NYO-794)

The relative effects of certain acids and of mixed solvents on the intensity of the boron flame are shown in tables. A graph shows per cent transmission of B as a function of wavelength. Other studies led to the following conclusions: The photomultiplier attachment of the Beckman DU Quartz photoelectric spectrophotometer permitted the use of smaller slit widths and greatly reduced interferences. In materials where B is a major constituent and Na and K are minor constituents, these elements probably would not interfere. Na, K, and Ba enhancements of the B flame emission were due to photochemical processes.

1656
New Brunswick Lab.
SPECTROPHOTOMETRIC DETERMINATION OF TITANIUM AND IRON IN ZIRCONIUM WITH TIRON, by R. H. Beaumont, Jr. May 1951. 14p. (NYO-2016)

A method is described using tiron for the determination of traces of Fe and Ti in Zr metal. Zr metal is dissolved in dilute hydrofluoric acid, and the complex developed at a pH 4.7 by addition of ammonium acetate. No precipitate of Zr compounds is formed and the determination can be carried out according to the general procedure of Yoe and Armstrong. The absorbancy of the solution containing the blue ferric Fe complex and the non-interfering Ti complex is measured at 560 mμ. The Fe is then reduced to the ferrous state by the addition of a small amount of sodium hydrosulfite. The absorbancy of the solution containing the Ti complex is measured at 410μ. Beer's law is followed closely in both cases. Tiron, as used in this procedure, is about ten times as sensitive as peroxide for Ti and nearly a quarter as sensitive as o-phenanthroline for Fe. Of the ions that interfere, only Cu has been found present and that in but a few samples. A method is discussed for the removal of Cu, when present, by a dithizone extraction. (auth)

1657
New Brunswick Lab.
REPORT OF THE ANALYSES OF STANDARD BERYLLIUM SAMPLES, by G. J. Petretic. Aug. 1951. 19p. (NYO-2020)

Chemical and spectrographic analyses of Be metal samples are tabulated. These samples have been analyzed by a number of cooperating laboratories in conjunction with the beryllium program carried out by the AEC. The tentative recommended values are reported.

1658
Towne Scientific School, Univ. of Penn.
THERMODYNAMIC STUDY OF IRON-OXYGEN-SULFUR SYSTEM; SIXTH QUARTERLY REPORT, by F. J. Dunkerley, J. L. Nichols, and V. V. Damiano. Jan. 1, 1952. 6p. (NYO-3390)

The H_2-reduction apparatus for the determination of S and O in Fe samples has been improved by employing high-purity alumina thermocouple-protection tubes and substituting a silica combustion boat for the alundum one to eliminate the high water blank. The effect of surface oxides on the determination of body O is shown. Analyses for body O and S in typical Fe-S-O melts are tabulated. Fusion of lathe turnings with Sn in a 50-50 wt.% mixture at 1180°C was superior to fusion with the Sn-Sb alloy previously used; less extraneous S and O were introduced.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

1659
Wisconsin Univ.
THE INFLUENCE OF STRUCTURE PHASE AND ADDED IODINE ON THE ORGANIC YIELDS OF THE $I^{127}(n,\gamma)I^{128}$ REACTION IN ALKYL IODIDES, by Gerrit Levey and John E. Willard. [nd] 27p. (AECU-1847)

The organic yields of the (n,γ) reaction on iodine in purified methyl, ethyl, propyl, and butyl iodides have been determined in the liquid phase as a function of I_2 concentration, and in the solid phase at −190°C. In the case of

the methyl and ethyl compounds the relative amounts of the different organic products containing tagged iodine have been determined. All of the compounds tested show a rapid decrease in organic yield with increasing I_2 concentration at low concentrations followed by a much slower decrease at higher concentrations, in agreement with earlier indications that organic combination occurs by more than one kind of process. The organic yields of the liquid primary iodides (ethyl, n-propyl, n-butyl and isobutyl) are essentially equal, but different from the yields of the secondary iodides (isopropyl and sec-butyl), indicating a structural effect on the hot-atom processes. In contrast to most previous examples of phase effects on such processes, isobutyl, sec-butyl, and ethyl iodides do not give significantly higher organic yields in the solid phase, at −190°, than in the liquid phase. It seems necessary to use new concepts of the mechanism of hot-atom processes to explain the results.

1660

Carnegie Inst. of Tech.

CRITICAL SHEAR STRESSES IN BODY-CENTERED CUBIC LATTICES, by R. Smoluchowski. Jan. 8, 1952. 11p. (NYO-3179)

A consideration of the shape and the atomic configuration of dislocations in a body-centered cubic lattice allows an estimate of the ratio of critical shear stresses on various slip planes as a function of temperature. A comparison with experimental data is satisfactory. (auth)

1661

THE CRYSTAL STRUCTURE OF LITHIUM AMIDE. Robert Juza and Karl Opp. Z. anorg. u. allgem. Chem. 266, 313-24 (1951) Nov. (In German)

$LiNH_2$ has a tetragonal structure, with a = 5.016 A, c = 10.22 A, and c/a = 2.038. There are 8 $LiHN_2$ molecules per unit cell, the x-ray density is 1.186, and the pyknometric density is 1.183. The space group is S_4^2 with the NH_2^- ions in 8g positions with x = y = 2z = 0.232 and the Li^+ ions in 4e with z = ¼ and in 4f with z = 0. The NH_2^- ions have approximately dense-cubic arrangement, and the Li^+ ions occupy half the tetrahedral vacancies in each layer arrangement. The univalent radius of the NH_2^- ion is 1.67 A. No high-temperature modification of higher symmetry exists.

FLUORINE AND FLUORINE COMPOUNDS

1662

Johns Hopkins Univ.

THE EFFECT OF HYDROGEN ON THE STABILITY OF, AND THE STABILIZATION OF PERFLUORO OILS TOWARD FLUORINE, by C. E. Weber. [nd] Decl. Feb. 12, 1948. 41p. (AECD-3307; Research Paper No. V)

1663

Carbide and Carbon Chemicals Co. (K-25)

FLUORINE GENERATOR DEVELOPMENT, by R. A. Ebel and G. H. Montillon. Issued Jan. 22, 1952. 35p. (K-858)

This report presents a discussion of polarization, electrolyte purity, carbon anodes, corrosion, and materials of construction, and fluroine cell design based on an extensive review of published literature, project literature, and Process Division progress reports. (46 references) (auth)

1664

A CONVENIENT METHOD FOR FLUORINATING CERTAIN CHLOROCARBONS WITH ANTIMONY TRIFLUORIDE. H. Dean Mallory. J. Am. Chem. Soc. 74, 839-40(1952) Feb. 5.

The process described requires no special apparatus and when applicable is capable of yielding high-purity fluorocarbons. It was developed specifically for the preparation of methylfluoroform from methylchloroform although it is well adapted to the preparation of difluorodichloromethane from CCl_4, or difluorochloromethane from chloroform. This process is applicable if the final product is gaseous at room temperature or slightly above and is the most highly fluorinated compound obtainable with SbF_3. The final product will contain on the order of 95% of the highest fluoride. An exception is noted with ethylidene fluoride.

1665

INFRA-RED SPECTRA AND THE SOLID STATE. III. POTASSIUM BIFLUORIDE. G. L. Cote and H. W. Thompson. Proc. Roy. Soc. (London) 210A, 206-16(1951) Dec.

The infra-red spectrum of potassium bifluoride has been determined between 2 and 8 μ at temperatures between 293 and 90°K. On passing from room temperature to that of liquid air, some of the absorption bands sharpen and split. The results have been analyzed with the object of assigning fundamental vibration frequencies to the $(HF_2)^-$ ion, and also of deciding whether this ion has a symmetrical or unsymmetrical structure. Values assigned to the stretching vibration frequencies are 600 and 1450 cm^{-1}, and to the deformation a pair at 1225/1274 cm^{-1}. The spectrum can then be satisfactorily explained in terms of the selection rules which would be expected for a symmetrical $(HF_2)^-$ ion lying in the particular crystal field suggested by X-ray work. Whereas the bending vibrations appear to involve little anharmonic character, there is an apparently large negative anharmonic coefficient for the overtone and combinations of the stretching vibration frequencies. This might be expected if the potential energy function for the antisymmetrical stretching vibration involved a higher power of the displacement coordinate than the second, and strengthens the interpretation in terms of a symmetrical ion. The molecular environment of the ion in the crystal state leads to a removal of the degeneracy of the deformational vibration, the latter being found to split, although one component is not noticed in absorption when the crystal is viewed along the c-axis. (auth)

1666

INFRA-RED SPECTRA AND THE SOLID STATE. IV. BOROFLUORIDES. G. L. Cote and H. W. Thompson. Proc. Roy. Soc. (London) 210A, 217-23(1951) Dec.

The vibrational spectra of the solid crystalline borofluorides of ammonium, potassium, and sodium have been measured between 2 and 25 μ, both at room temperature and at that of liquid air. The bands observed have been assigned to vibrational frequencies of the $(BF_4)^-$ and $(NH_4)^+$ ions. Some of the bands are found to split into two or more components, and this splitting has been considered in terms of isotopic species and in relation to the removal of vibrational degeneracy which may arise when the tetrahedral ions are situated in a crystal field of lower symmetry. (auth)

1667

INFRARED SPECTRUM OF SOME COMPLEX HEXAFLUORIDES. A. de Lattre. J. Chem. Phys. 19, 1610(1951) Dec.

Infrared-absorption studies of cryolite, Na_3AlF_6, gave constants in good agreement with those predicted for a purely ionic molecule. Four samples of fluoferrates of Na and ammonium studied by the powder method all give a diffuse band in the region 492 to 458 cm^{-1}, and a sample of KPF_6 gives strong well-defined peaks at 847 and 561 cm^{-1}. Frequencies of KPF_6 are listed for both a PF_4^+ tetrahedral and a PF_6^- octahedral structure.

1668

THE SPECTRA OF BROMINE PENTAFLUORIDE. T. G. Burke and E. A. Jones. J. Chem. Phys. 19, 1611(1951) Dec.

Infrared and Raman fundamental frequencies of liquid BrF_5 are listed. The data favor the triagonal bipyramid C_{4v} model over the tetragonal pyramid D_{3h}.

GRAPHITE

1669

STUDY OF THE ADSORPTION OF OXYGEN ON CARBON BY THERMOELECTRONIC EMISSION. Xavier Duval. Compt. rend. 234, 208-10(1952) Jan. 7. (In French)

Study of the thermal emission of electrons by a carbon filament over the temperature range 1150 to 2000°K in a current of O_2 at pressures of 5×10^{-5} to 5×10^{-4} mm Hg indicates that no film of O is formed on the carbon under these conditions.

LABORATORIES AND EQUIPMENT

1670

Columbia Univ.

QUARTERLY PROGRESS REPORT; THERMODYNAMIC PROPERTIES OF SODIUM VAPOR, by W. A. Selke, C. H. Muendel, and H. Y. Krinsky. Jan. 1, 1952. 5p. (NYO-3097)

An apparatus for obtaining vapor-pressure data for sodium in the range 0.1 to 5 atmospheres absolute pressure is described. Materials of construction, heating requirements, pressure measurements, and temperature control are discussed. This apparatus is currently being constructed.

MOLECULAR STRUCTURE

1671

VARIATIONS IN ABSOLUTE CHEMICAL SHIFT OF NUCLEAR INDUCTION SIGNALS OF HYDROXYL GROUPS OF METHYL AND ETHYL ALCOHOL. J. T. Arnold and M. E. Packard. J. Chem. Phys. 19, 1608-9(1951). Dec.

The temperature dependence of the proton nuclear-induction resonance associated with the OH group in C_2H_5OH is plotted between 150 and 350°K. The effect of solution in CCl_4 on the chemical shift of the OH group in CH_3OH and C_2H_5OH is plotted and shown to be similar to the temperature effect. The nuclear-induction methods used in this investigation are described briefly.

1672

TEMPERATURE DEPENDENT MAGNETIC SHIELDING IN ETHYL ALCOHOL. Urner Liddel and Norman F. Ramsey. J. Chem. Phys. 19, 1608(1951) Dec.

The temperature dependence of the weakest proton nuclear-induction resonance observed in C_2H_5OH, presumably that associated with OH, may be attributed to association of the C_2H_5OH or to effects of temperatures on H angle vibrations and hindered rotation. Experiments for distinguishing between these alternatives are suggested.

1673

THE PURE QUADRUPOLE SPECTRUM OF SOLID VINYL CHLORIDE. J. H. Goldstein and Ralph Livingston. J. Chem. Phys. 19, 1613(1951) Dec.

Pure quadrupole transitions for Cl^{35} in vinyl chloride have been observed at a frequency of 33.414 Mc at 77°K and 33.613 Mc at 20°K. On the assumption of a cylindrically symmetrical field, these frequencies lead to a value of about −67 Mc for the coupling constant, $eQ\phi_{zz}$. This result compares well with that obtained from microwave hyperfine structure, leading to the conclusion that the C−Cl bond is a principal axis of the field gradient tensor. The effect of bond asymmetry on the calculated coupling constants in the solid is shown to be negligible.

RADIATION CHEMISTRY

1674

Canisius Coll.

ON THE EFFECT OF IODINE IN THE RADIOLYSIS OF THE HYDROCARBONS, by Clarence C. Schubert and Robert H. Schuler. Dec. 1951. 5p. (NYO-3259)

Iodine has been shown to be without chemical effect on the production of H and methane in the radiolysis of cylohexane and 2,2,4 trimethylpentane. At high concentration, I causes added absoprtion, increasing the observed rate without observably changing the yield. (auth)

1675

ON THE DEVELOPMENT OF RADIOCHEMISTRY. Lise Meitner. Angew. Chem. 64, 1-4(1952) Jan. 7. (In German)

The article is dedicated to Otto Hahn on the 50th anniversary of his doctorate and reviews briefly the history of radiochemical discoveries with particular attention to Hahn's work.

RADIATION EFFECTS

1676

Notre Dame Univ.

RADIATION SENSITIVITY OF BENZENE-d_6, by Sheffield Gordon and Milton Burton. [nd] 2p. (AECU-1856)

Of organic compounds, the aromatic are the most resistant to radiation and of these the most resistant heretofore reported is benzene (Burton, J. Chem. Education, 28, 404(1951)). For example, it is less sensitive to decomposition by high-energy radiation than aliphatic hydrocarbons by a factor approximating 100. It has been shown (Manion and Burton, J. Phys. Chem., publication forthcoming (1952)) that the 100-ev yields of gaseous products from liquid benzene irradiated with 1.5-Mev electrons from a HVEC Van de Graaff generator are respectively $G(H_2) \simeq 0.037$ and $G(C_2H_2) \simeq 0.022$. We have now examined the radiation chemistry of benzene-d_6 and find that it is even more resistant to high-energy radiation than benzene with yields $G(D_2) \sim 0.011$ and $G(C_2D_2) \sim 0.013$. These results are undoubtedly to be correlated with differences of zero-point energy of C−H and C−D and perhaps of C−C vibrations in the two compounds but no simple relationship can be expected. The fact that $G(H_2) > G(C_2H_2)$ while $G(D_2) < G(C_2D_2)$ suggests that in radiolysis benzene decomposes by at least two essentially different processes. It is noteworthy that benzene-d_6 has the lowest presently known radiation sensitivity of any liquid organic substance. (Entire report)

1677

Argonne National Lab.

MECHANISM AND RATE CONSTANTS OF THE γ-RAY INDUCED DECOMPOSITION OF HYDROGEN PEROXIDE IN AQUEOUS SOLUTIONS, by Edwin J. Hart and Max S. Matheson. Jan. 24, 1952. 35p. (AECU-1868; UAC-501)

A mechanism for the γ-ray initiated decomposition of dilute aqueous solutions of H_2O_2 has been deduced from data showing a dependence of decomposition yield on the square root of H_2O_2 concentration and inverse square root of dosage rate. A novel feature of this mechanism is that termination occurs through a thermolecular reaction involving two hydroperoxy radicals and a H_2O_2 molecule. The propagation and termination rate constants have been measured in intermittent radiation experiments which were carried out in paraffin-coated cells containing 0.1 M H_2O_2 under irradiation conditions yielding 30 molecules of oxygen per initiating radical. Evidence is presented showing that $HO_2 + H_2O_2 = H_2O + O_2 + OH$ and $2HO_2 + H_2O_2 = 2H_2O_2 + O_2$ are the rate determining propagation and termination steps. k_p is found to be 530 liter $mole^{-1}sec.^{-1}$ and $2k_t$ equals 5.3×10^{10} $liter^2$ $mole^{-1}sec.^{-1}$.

1678

Brookhaven National Lab.

MECHANISM OF DECOMPOSITION OF WATER BY IONIZING RADIATIONS, by Augustine O. Allen. [nd] 21p. (BNL-1080)

Irradiated water undergoes a decomposition to molecular H_2 and H_2O_2, simultaneously with the decomposition to free radicals, H and OH. With γ rays or hard x rays, the yield of the molecular decomposition is about 0.6 H_2 molecules formed per 100 ev absorbed, and the yield of free radicals appears to be about 3 to 5 radical pairs per 100 ev. As the ionization density of the radiation is increased, the molecular yield increases and the free radical yield falls. The decomposition of pure water reverses itself because the free radicals initiate a back reaction between the decomposition products. The rate of the back reaction increases with increasing concentration of dissolved H_2 but decreases with increasing concentration of dissolved O_2 or H_2O_2. This unusual type of kinetics leads to some peculiar phenomena in water radiolysis. The molecular decomposition is ascribed to reactions occurring in the very small regions of high energy density along the charged particle track (hot spots) which correspond to the "ion clusters" formed by fast particles in a gas. (auth)

1679

CHEMICAL EFFECTS OF SLOW NEUTRON CAPTURE. J. H. Green. Revs. Pure Applied Chem. 1, 235-56(1951) Dec.

Chemical effects caused by neutron-capture processes, calculation of recoil energy and its distribution, Szilard-Chalmers separation, and other aspects of the theory and techniques of radiative-capture chemistry are reviewed briefly. 96 references.

1680

THE RADIATION-CHEMICAL TRANSFORMATION OF NITROGEN MUSTARDS IN AQUEOUS SOLUTION. E. H. Graul. Z. Naturforsch. 6b, 465-6(1951) Nov.-Dec. (In German)

HCl formation and ion-pair yield in aqueous solutions of methyl dichlorodiethylamine and trichlorotriethylamine exposed to 0 to 600,000 r of x radiation are reported. A reaction scheme based on the theory of indirect action of radiation by formation of H+OH from the H_2O is given.

1681

ON A PRIMARY PHOTOGRAPHIC EFFECT PRODUCED BY THE COMBINED ACTION OF X RAYS AND LIGHT. Héliodose Tellez-Plasencia. Compt. rend. 234, 206-8(1952) Jan. 7. (In French)

An unsensitized AgBr emulsion was exposed to 0.03 r of x rays for 8 sec to 1 hr followed by 500 lux of white light for 5 min to several hr. The effect of the light and of various chemical Br acceptors on development of the latent image is discussed.

RARE EARTHS AND RARE-EARTH COMPOUNDS

1682

Los Alamos Scientific Lab.

A SPECTROPHOTOMETRIC DETERMINATION OF THE COMPLEX FORMED BETWEEN CEROUS AND SULFATE IONS, by T. W. Newton and G. M. Arcand. [nd] 7p. (AECD-3299; LADC-1089)

Spectrophotometric determinations of the first dissociation constant of $CeSO_4^+$ were made at 25°C and at five ionic strengths from 0.2 to 2.0. The relatively weak band at 296 mμ in the absorption spectrum of Ce(III) was found to increase in intensity with increasing SO_4^{--} concentration and was used for the determinations. By varying the concentrations of Ce(III), SO_4^{--} and H^+, it was found that the equilibrium can be represented by $Ce^{+3} + SO_4^{--} \rightleftharpoons CeSO_4^+$. The data at high SO_4^{--} concentrations indicate that at constant ionic strength the activity coefficient ratio, $(\gamma\ Ce^{+3})(\gamma\ SO_4^{--})/(\gamma\ CeSO_4^+)$, is not constant or a higher complex is formed. The variation of the dissociation constant with ionic strength can be fitted to a Debye-Hückel type expression: $\log K = \log K^\circ + 0.509\ \Delta\ z^2\mu^{1/2}/(1 + 0.329\ a\ \mu^{1/2})$ with two parameters, a and K°.

1683

ON THE MECHANISM OF REDUCTION OF CERIUM DIOXIDE. Karl Hauffe and Horst Peters. Z. anorg. u. allgem. Chem. 266, 345-8(1951) Nov. (In German)

Observations recently published on the reduction of CeO_2 and CeO_2-ThO_2 and CeO_2-Pr_2O_3 mixed crystals by H_2 are shown to be explainable by a lattice-vacancy theory, the solid-state reaction taking place by diffusion of O^{--} ions.

1684

STUDY OF THE PEROXIDES OF PRASEODYMIUM. Marc Foëx and Jean Loriers. Compt. rend. 234, 220-2(1952) Jan. 7. (In French)

A product obtained by cooling very slowly (0.5°C/hr) in air an oxide prepared by heating $Pr(NO_3)_3$ at 650°C had a composition corresponding to $PrO_{2.2}$. Study of the thermal decomposition of this substance by weight change, dilatometry, and x-ray diffraction indicated a new phase consisting either of a hydroxide retaining no more than 0.45% H_2O on heating at 200°C or a peroxide of greater O content than PrO_2, perhaps Pr_2O_5.

SEPARATION PROCEDURES

1685

Michigan Univ.

RAPID SEPARATIONS OF PROTACTINIUM AND URANIUM RADIOISOTOPES FROM CYCLOTRON BOMBARDED THORIUM NITRATE, by W. Wayne Meinke. [nd] 5p. (AECU-1863)

Two rapid chemical procedures for the separation of Pa and U isotopes which reduce the separation times from 5 to 10 min to times of the order of 1 min are described.

1686

Toronto Univ. (Canada)

A CONTINUOUS LIQUID-LIQUID EXTRACTOR FOR SOLVENTS OF VARIOUS DENSITIES, by H. A. Bewick, J. E. Currah, and F. E. Beamish. Feb. 22, 1946. 15p. (CI-110)

1687

Institute for the Study of Rate Processes, Univ. of Utah

THEORY OF ADSORPTION ON ION EXCHANGE RESINS, by Milton E. Wadsworth and Melvin A. Cook. July 1, 1951. 20p. (NP-3563; Technical Report No. VII; U20311)

Data for several amine resins are analyzed according to the dehydrated-hydrated ion-pair theory in which 1 of the 2 ions is adsorbed in the dehydrated form in the compact double layer and the other remains hydrated in the diffuse double layer. This model is developed quantitatively and applied to the adsorption of AcOH, $CH_2ClCOOH$, HCl, HNO_3, and H_2SO_4 on Amberlite anion-exchange resins. It is suggested that anion-exchange capacity in polyamine resins is acquired by the compact-double-layer adsorption of H ions resulting in a charged surface. Exchangeable anions are thereby drawn into the diffuse double layer by means of this valence-bond-stabilized surface change. Activity coefficients for the solid phase are demonstrated to be a function of the bulk-solution ionic strength.(NRS abst.)

1688

THE PRODUCTION OF PURE CERIUM METAL BY ELECTROLYTIC AND THERMAL REDUCTION PROCESSES. P. M. J. Gray. Trans. Inst. Mining Met. 61, 141-72(1952) Jan.

The production of pure Ce by electrolytic reduction of its fused trichloride and its dioxide dissolved in a bath of fused fluorides and the thermal reduction of its trichloride and trifluoride are described. The purity of the metal obtained by the electrolysis of the fused trichloride was limited and

lower than that required. The metal purer than 99.8% Ce could not be obtained by the electrolysis of the dioxide. CeF_3 reduced by Li in a closed vessel yielded 99.93 pure Ce. Obtaining materials to withstand attack from molten Ce and its molten halides was a major difficulty but was overcome in most cases by the use of Mo, ceria or graphite.

1689
ANION EXCHANGE STUDIES. IV. COBALT AND NICKEL IN HYDROCHLORIC ACID SOLUTIONS. George E. Moore and Kurt A. Kraus. J. Am. Chem. Soc. 74, 843-4(1952) Feb. 5.

The anion-exchange behavior of Ni(II) and Co(II) in 0.5M to 12M HCl on Dowex-1 has been studied. Elution constants are plotted. There is negligible adsorption of Ni in the range 0.5M to 12M and of Co in the range 0.5M to 3M. Adsorption data of Co(II) are compared with those of Fe(III).

1690
QUANTITATIVE THEORY OF RARE EARTH SEPARATIONS ON ION-EXCHANGE COLUMNS. F. H. Spedding and J. E. Powell. J. Am. Chem. Soc. 74, 857(1952) Feb. 5

The derivation of quantitative relations among the variables involved in the separation of rare earths by elution with 0.1% citric acid between pH 5.5 and 7.3 is noted. It has been found that the predominating and only important rare-earth complex formed in this pH range is ($RE\ cit_2^{-3}$). Experimentally, it has been found that if the ammonium ion of the eluant, the H total of the eluant H_T (a summation of the H combined with H_3cit, H_2cit^-, and $Hcit^{--}$ + the H^+ ion), the H_T of the eluate, the ammonium ion of the eluate, and the rare-earth total of the eluate are plotted against the H^+ ion of the eluate, that linear curves result. The slopes of these lines can be calculated from theoretical considerations. The instability constant K for the ($RE\ cit_2^{-3}$) complex can be calculated for each of the rare earths.

1691
ELECTROLYTIC PREPARATION OF TITANIUM. G. D. P. Cordner and H. W. Worner. Australian J. Appl. Sci. 358-61 (1951) Sept.

The paper describes some exploratory experiments in which Ti powder was electrolytically deposited from a molten mixture of Ti trichloride with Li and K chlorides. The decomposition voltage of the electrolyte is just under 1 v, and the cathode current efficiency at current densities of about 6 amp/cm² is of the order of 60% under conditions obtaining in the experimental cell. It is shown that the cathode deposit grows in a fine, dendritic form, its grade being comparable with that of metal produced by the reduction of titanium tetrachloride with magnesium.

1692
THE EXTRACTION AND REFINING OF GERMANIUM AND GALLIUM. A. R. Powell, F. M. Lever, and R. E. Walpole. J. of Applied Chem. 1, 541-51(1951) Dec.

Sources of germanium and gallium are discussed and descriptions are given of processes for the recovery of these elements from flue dusts and from germanite. The flue-dust process involves smelting to recover the rare elements in a metallic regulus, dissolution of this regulus in ferric chloride solution with the aid of chlorine, distillation of crude germanium tetrachloride from the resulting solution, fractional distillation of the crude product to remove the bulk of the arsenic, and final rectification through a column packed with copper turnings to remove the remainder. After hydrolysis of the resulting tetrachloride germanium oxide is obtained with less than 0.1 ppm of arsenic. Gallium is recovered from the acid liquor in the first still by treatment with aluminium to remove heavy metals and to reduce the iron to ferrous chloride, followed by extraction of the gallium chloride in a continuous process with isopropyl ether, removal of the ether by distillation, purification of the aqueous phase with hydrogen sulphide, and conversion of the gallium into sodium gallate for electrolysis.

1693
SOLVENT EXTRACTION. Robert E. Treybal. Ind. Eng. Chem. 44, 53-63(1952) Jan.

In liquid extraction, noteworthy progress has been made in the gathering of equilibrium data and in the study of single liquid drops, mixing and settling characteristics of two-phase liquid mixtures, and methods of calculation particularly for double-solvent systems, as well as equipment design and operating characteristics. Metal separations, especially of the rarer metals, continued to occupy considerable attention. In the petroleum field activity was centered about the treatment of the lighter distillates, and a great many new applications of extraction to difficult separation problems were proposed. In leaching, the year's progress is characterized by fundamental studies on rates of diffusion in relatively simple systems, and suggestions for new solvents for oilseed processes. (auth) 377 references.

SPECTROSCOPY

1694
Argonne National Lab.
NOTE ON THE ABSORPTION SPECTRUM OF IODINE IN OXYGENATED SOLVENTS, by Leonard I. Katzin. Jan. 25, 1952. 7p. (AECU-1865; UAC-503)

The absorption spectrum of I in oxygenated water, isopropyl alcohol, and carbon tetrachloride mixed with isopropyl alcohol were determined. Comparison is made with I spectra in other solvents and the sensitivity of I ions to solvents is discussed.

1695
Duke Univ.
TECHNICAL REPORT NO. 6, by H. Sponer. Dec. 20, 1951. 68p. (NP-3592; Technical Report No. 6; U20378)

Reprints are included concerning (1) the singlet-transition levels in naphthalene and an interpretation of the absorption system at 3200 to 2900 A as a $^1A_{1g} - A_{1g}$ transition (Discussions Faraday Soc., No. 9(1950)); (2) calculations of electric dipole moments of compounds with 6 π-electrons having the character of perturbed benzene rings (J. Chem. Phys. 19, 1323(1951)); and (3) derivation of a perturbation formula in the solution of the quantum mechanical eigenvalue problem when a series of approximate eigenfunctions are known (J. Chem. Phys. 19, 1396(1951)). (cf. TIP U20379-U20380, U17076, U11285).

Separate abstracts have been prepared on the following sections of this report: On the Calculation of Electronic Levels in Pyridine and the Isomeric Picolines, sect.4; and Spectroscopic Studies in the Near Ultraviolet of the Three Isomeric Dimethylbenzene Vapors. I. Absorption and Fluorescence Spectra of Para Dimethylbenzene, sect.5.

1696
ON THE INFRARED SPECTROMETRY OF N^{15}-LABELED PHTHALYL GLYCINE ETHYL ESTER. Felix Friedberg and Lawrence M. Marshall. J. Am. Chem. Soc. 74, 833 (1952) Feb. 5.

In the course of a study on the spectra-structure correlation in simple peptides, it was observed that phthalyl glycine ethyl ester labeled with N^{15} exhibited a characteristic shift of its spectrum to the right in the region from 1430 to 1350 cm^{-1} when compared to the N^{14} control. Hence, especially in physiological investigations, infrared spectrometry may be of value in the detection and identification of compounds labeled with N^{15}.

SYNTHESES

1697

Oak Ridge National Lab.

AN OXIDATIVE CYCLE IN THE PROPIONIC ACID BACTERIA (abstract), Eugene A. Delwiche and S. F. Carson. [nd] 1p. (AECU-1871)

Intact cells of Propionibacterium pentosaceum, E214, grown aerobically, possess the ability to oxidize citric acid cycle intermediates with the exception of citrate. Cell-free extracts quantitatively oxidize citrate to α-ketoglutarate. Acetone-dried cells synthesize citrate from pyruvate and oxalacetate, and from acetate and oxalacetate. The data are discussed in terms of an "oxidative" conversion of acetate to propionate under both aerobic and anaerobic conditions. (Entire Report. Abstract of paper for Boston meeting of Society of American Bacteriologists, April 27, 1952.)

1698

Commissariat a l'Énergie Atomique (France)

[PREPARATION OF $NaBr^{80,82}$ OF HIGH SPECIFIC ACTIVITY IN THE CHATILLON PILE.] PREPARATION DE $^{80,82}BrNa$ DE GRANDE ACTIVITÉ SPÉCIFIQUE A LA PILE DE CHATILLON, by C. Fisher, C. Herczeg, and H. Laurent. Oct. 1951. 10p. (CEA-95)

The Szilard-Chalmers reaction was used to concentrate the $Br^{80,82}$ produced by pile irradiation of an organic bromide, solvent partition being carried out between benzene and H_2S-saturated H_2O. Specific activities produced by various lengths of irradiation of bromoform, ethyl bromide, and ethylene bromide are tabulated. Bromoform is recommended for production since it gives the highest specific activity. The enrichment factor decreases with extended irradiation time.

1699

Commissariat a l'Énergie Atomique (France)

[MICROSYNTHESES USING C^{13} OR C^{14}. II. MICROPREPARATIONS OF METHYL ALCOHOL, METHYL IODIDE, AND SODIUM ACETATE LABELED IN THE METHYL GROUP.] MICROSYNTHÈSES POUR L'EMPLOI DE CARBONE 13 OU DE CARBONE 14. II. MICROPRÉPARATIONS D'ALCOOL MÉTHYLIQUE D'IODURE DE MÉTHYLE ET D'ACÉTATE DE SODIUM MARQUÉ SUR LE GROUPEMENT MÉTHYLE, by C. Baret and L. Pichat. Nov. 1951. 12p. (CEA-99)

Apparatus and technique are described in detail for (1) reduction of C^*O_2 to C^*H_3OH with $LiAlH_4$, (2) conversion of the methanol to C^*H_3I by HI, (3) formation of the Mg Grignard reagent, and (4) addition of inactive CO_2 to form C^*H_3COOH. All these operations have been carried out on 0.005 moles. Methyl-labeled Na acetate has been prepared in 67% yield based on the $BaC^{14}O_3$ used as starting material.

1700

National Bureau of Standards

PREPARATION OF D-MANNITOL-1,6-C^{14} AND ITS CONVERSION TO D-FRUCTOSE-1,6-C^{14} BY ACETOBACTER SUBOXYDANS, by H. S. Isbell and J. V. Karabinos. Feb. 1, 1952. 14p. (NBS-1419)

Production of D-mannitol-1,6-C^{14} in over-all radiochemical yield of 80% has been accomplished by (1) preparation of D-mannono-γ-lactone-1-C^{14} by the method of Isbell et al. (report NBS-1368), (2) conversion of the lactone to D-mannose-1-C^{14} by Na-amalgam reduction, and (3) catalytic reduction of the sugar with H_2. Oxidation to D-fructose-1,6-C^{14} by incubation with Acetobacter suboxydans had a highly time-dependent yield. A radiochemical yield of 54.4% is reported.

1701

Minnesota Mining and Manufacturing Co.

QUARTERLY PROGRESS REPORT NO. 9; MAY, 1951 TO JULY, 1951, by W. H. Pearlson. 24p. (NP-3590; Quarterly Progress Report No. 9)

A progress report is presented on the preparation and evaluation of oil-resistant fluorinated elastomers suitable for use at low temperatures.

1702

Atomic Energy Project, Univ. of Calif., Los Angeles

THE DECARBOXYLATION AND RECONSTITUTION OF LINOLEIC ACID, by David R. Howton, Robert H. Davis, and Judd C. Nevenzel. Issued Feb. 8, 1952. 21p. (UCLA-183)

A method has been devised by which linoleic acid isolated from natural sources may be used as a starting material for the preparation of the substance tagged with isotopic carbon in the carboxyl group. In essence, the carboxyl group of linoleic acid is replaced by a bromine atom via the silver-salt degradation of Borodin and the process reversed via the Grignard reaction, the sensitive and synthetically-imposing cis,cis-1,4-diene hydrocarbon moiety being protected in steps where this is necessary by bromination. (auth)

1703

Radiation Lab., Univ. of Calif.

FIXATION OF CARBON DIOXIDE BY BARLEY ROOTS, by L. W. Poel. Nov. 30, 1951. 5p. (UCRL-1583)

Factors involved in the fixation of CO_2 by plant roots and the compounds in which the absorbed carbon appears were investigated using radioautograms made from chromatograms. The principal, nonvolatile, 80% ethanol-soluble compounds found to be radioactive were malic, citric (or isocitric), aspartic, and glutamic acids, asparagine, glutamine, serine and tyrosine, with traces (in some experiments) of α-ketoglutaric acid, alanine, and several undetermined compounds. A typical radioautograph is reproduced.

1704

THE ACTION OF INVERTASE PREPARATIONS [ON SUCROSE]. S. Aronoff. Arch. Biochem. Biophys. 34, 484-5 (1951) Dec.

Radiograms of equal aliquots of sucrose after hydrolysis by invertase on filter paper showed no evidence of a trisaccharide as an intermediate.

ENGINEERING

1705

Kellex Corp.

INSTRUMENT NEEDS OF THE RADIOCHEMICAL PROCESSING PLANT, by V. L. Parsegian. Sept. 30, 1949. 38p. (AECU-1862)

This study is an introduction to the instrument problems of the radiochemical plant, to aid manufacturers of industrial instruments and chemical engineers who are concerned with these problems. The types of measurement that have been found useful in conventional industrial applications are reviewed; emphasis is given to the general principles of detection, telemetering, automatic control, and instrument design that can be useful in radiochemical plants. A plea is made for design of instruments better suited to these plants, and for more effective use of radiation measurement in monitoring radiochemical processes. (auth)

1706

Brookhaven National Lab.

COOKING WITH HOT ATOMS, by Robert V. Horrigan. [nd] 9p. (BNL-1078)

A brief, nontechnical description is given of the AEC program for recovering radioactive fission products and developing industrial uses for them.

1707
Knolls Atomic Power Lab.
INTERIM REPORT; CONTROL ROD GAS SEALS, by W. A. Heywood and C. J. Hibbert. Jan. 14, 1952. 83p. (KAPL-669)

Apparatus designed to test gas seals for the KAPL Intermediate Power Breeder reactor control rods is described. Specifications and drawings of the seals are included and test data are given.

AEROSOLS

1708
Illinois Univ.
IMPACTION OF DUST AND SMOKE PARTICLES ON SURFACE AND BODY COLLECTORS, by W. E. Ranz and J. B. Wong. [nd] 49p. (AECU-1859)

An investigation of the mechanism of collection of dust and smoke particles of submicron size was undertaken from the standpoint of a fundamental study of the impaction of aerosol particles on elementary collectors. The systems analyzed were (1) rectangular and round aerosol jets impinging on flat plates (jet impactors and impingement separators); (2) cylindrical and spherical collectors placed in aerosol streams (fibrous filters and wet scrubbers). Experimental data are presented on impaction efficiencies of glycerol and sulfuric acid aerosols of nearly uniform size under various flow conditions. Rates of collection were determined for impaction on wires and spheres in aerosol streams moving at various velocities, and for impingement on flat plates from rectangular and round aerosol jets of different sizes. The results were correlated in terms of impaction efficiencies as a function of the particle diameter, a characteristic dimension of the jet or collector, and the velocity of the aerosol stream. Theories for the physical motion of small particles and for impaction on collectors were compared with the experimental results. Electrostatic effects were also taken into consideration. Application to practical processes are shown. (auth)

HEAT TRANSFER AND FLUID FLOW

1709
RAND Corp.
THE INFLUENCE OF "TUBE" SIZE ON THE SHAPE OF THE REACTOR FOR A SPECIFIED HEAT TRANSFER AND FLOW FRICTION PERFORMANCE, by A. L. London. Aug. 19, 1947. Decl. Nov. 17, 1949. 16p. (AECD-3308; RAD-206(RAND))

1710
Metallurgical Lab., Univ. of Chicago
STABILITY OF SPLIT HOLLOW CYLINDERS, by W. Karush and A. T. Monk. June 29, 1944. Decl. Feb. 11, 1952. 10p. (AECD-3312; CP-1900(A-2666) rev.)

The thermo-elastic problems arising when a hollow cylinder with a single lengthwise split is raised from zero temperature to a radially symmetric temperature field are investigated. An expression for the change of inner radius is obtained. For the case of uniform heat production and internal cooling, the condition of stability (i.e., decrease of inner radius on heating) holds for any dimensions of practical interest when the inner surface has a zero temperature rise. The minimum heat-transfer coefficient across the inner surface necessary to maintain stability also is obtained, and a special case of internal and external cooling is considered.

1711
Langley Memorial Aeronautical Lab., NACA
HIGH-ALTITUDE COOLING. IV. INTERCOOLERS, by K. F. Rubert. Sept. 1944. 15p. (NACA-ARR-L4I11c)

The variation of intercooling requirements with altitude is discussed and the corresponding effects on intercooler design are shown. A discussion is also given of the relations among the various design parameters and of the ranges of choice in design. The important effects of the various factors on intercooler proportions are illustrated with charts for the Harrison copper cross-flow intercooler. (auth)

1712
Lewis Flight Propulsion Lab., NACA
EXPERIMENTAL INVESTIGATION OF FORCED-CONVECTION HEAT-TRANSFER CHARACTERISTICS OF LEAD-BISMUTH EUTECTIC, by Bernard Lubarsky. Sept. 20, 1951. 30p. (NACA-RM-E51G02)

The forced-convection heat-transfer characteristics of Pb-Bi eutectic were experimentally investigated. Experimental values of Nusselt number for Pb-Bi fell considerably below predicted values. The addition of a wetting agent did not change the heat-transfer characteristics.

1713
Lewis Flight Propulsion Lab., NACA
EXPERIMENTAL DETERMINATION OF TIME CONSTANTS AND NUSSELT NUMBERS FOR BARE-WIRE THERMOCOUPLES IN HIGH-VELOCITY AIR STREAMS AND ANALYTIC APPROXIMATION OF CONDUCTION AND RADIATION ERRORS, by Marvin D. Scadron and Isidore Warshawsky. Jan. 1952. 81p. (NACA-TN-2599)

The relations among Nusselt, Reynolds, and Mach numbers for cylinders mounted in cross flow to an air stream, in the ranges 250 < Reynolds number < 30,000 and 0.1 < Mach number < 0.9, have been obtained from experimental determinations of the time constants of bare-wire thermocouples. This information has been used to prepare nomographs for ready computation of approximate values of time constants, radiation errors, and conduction errors for bare cylindrical-wire thermocouples in high-temperature high-velocity gas streams.

1714
Naval Ordnance Lab.
ON SOME TWO- AND THREE-DIMENSIONAL PROBLEMS IN HEAT CONDUCTION, by Arnold N. Lowan. Naval Ordnance Lab. and Yeshiva Univ. August 20, 1951. 37p. (NAVORD-1837; U20530)

The differential equation $\left(\frac{\partial}{\partial t} - K\,\nabla^2\right) T(p,t) = F(p,t)$ is solved for the following initial and boundary conditions:

a) $t \lim_{t\to\infty} T(p,t) = \mathcal{F}(p)$

b) $T(\bar{p},t) = \phi(\bar{p},t)$

c) $\frac{\partial}{\partial n} T(\bar{p},t) = \phi(\bar{p},t)$

d) $\left(\frac{\partial}{\partial n} - K\right) T(\bar{p},t) = \phi(\bar{p},t)$

where p is a point of one of the following domains:

1) $-\infty < x < \infty, \quad 0 < y < \infty$

2) $0 < x < \infty, \quad 0 < y < \infty$

3) $-\infty < x < \infty, \quad -\infty < y < \infty, \quad 0 < z < \infty$

4) $0 < x < \infty, \quad -\infty < y < \infty, \quad 0 < z < \infty$

5) $0 < x < \infty, \quad 0 < y < \infty, \quad 0 < z < \infty$

and $\bar{p}$ is a boundary point of one of these domains. (NRS abst.)

1715
THERMAL CONVECTION IN A MAGNETIC FIELD. W. B. Thompson. Phil. Mag. (7) 42, 1417-32(1951) Dec.

The modifications produced in the Rayleigh-Jeffreys theory (Phil. Mag. 2, 833(1926)) of slow thermal convection by magneto-hydrodynamic effects in a conducting fluid

placed in a magnetic field are examined. Even for a non-viscous fluid, a critical temperature gradient β_0 must be exceeded in order that convection occur. In this, the place of viscosity η occurring in the Rayleigh-Jeffreys formula is taken by a quantity η_H depending on the conductivity of the fluid, the magnetic field strength H and depth of fluid; thus $\eta_H = (4/27)(d^2/\pi^2)(\sigma\mu^2H^2/c^2)$. If the fluid is viscous a multiple of the normal viscosity depending on H must be added to η_H. An estimate of the critical gradient is made for somewhat artificial boundary conditions and it is found large enough to be experimentally detectable. The applicability of Jeffreys's method of marginal stability is discussed and the nature of possible oscillations investigated. (auth)

1716
THE BOUNDARY LAYER IN THREE DIMENSIONAL FLOW. PART II. THE FLOW NEAR A STAGNATION POINT. L. Howarth. Phil. Mag. (7) 42, 1433-40(1951) Dec.

The equations of boundary-layer flow in the vicinity of a stagnation point on a general (three-dimensional) surface are discussed and shown to be reducible to a pair of simultaneous ordinary third-order differential equations containing a single parameter c which is determined by the mainstream flow. The variation of c can be effectively limited to the range from 0 (corresponding to two-dimensional flow) to 1 (corresponding to the axial flow past a body of revolution), and solutions have been computed for the cases c = 0.25, 0.50, 0.75 and are tabulated. A series expansion useful for small c is also given. (auth)

1717
MEASUREMENT OF CONVECTION COEFFICIENTS AT GREAT VELOCITIES AND HIGH TEMPERATURES. Edmond Brun and Max Plan. Compt. rend. 234, 54-6(1952) Jan. 2. (In French)

Investigation of forced convection at high velocities and temperatures has been studied in an apparatus consisting essentially of a German-silver tube electrically heated to 850°C in a jet of air having velocities between Mach 0.35 and 2.95. Representation and accuracy of the results are discussed.

1718
CONICAL FLOW IN THE REGION OF A JUNCTION POINT. Jean Legras. Compt. rend. 234, 181-3(1952) Jan. 7. (In French)

Representations are derived for the case of supersonic conical flow at a plane obstacle bounded by a right angle, the edge of attack being perpendicular to the velocity at infinity of the fluid. The obstacle is partly interior and partly exterior to the Mach cone.

1719
FLUID DYNAMICS. Max Leva and Murray Weintraub. Ind. Eng. Chem. 44, 68-75(1952) Jan.

The literature on fluid dynamics continued its steady growth in 1951, marked chiefly by the addition of empirical correlations in the fields of fluidization and of flow through pipes and packed beds. Thixotropic flow and viscosity measurements also received the attention of a number of investigators, and there was the usual amount of interest shown in instrumentation and measurement. (auth) 259 references.

1720
HEAT TRANSFER. George T. Skaperdas. Ind. Eng. Chem. 44, 75-84(1952) Jan.

Extension of heat transfer literature into the recently developing fields of turbulent flow theory, liquid metals, surface boiling phenomena, and compressible flow continued during 1951. Additional data for more usual process conditions appeared, however, and a feature of the last review period was the large number of papers investigating heat transfer problems encountered in fixed or fluidized bed heterogeneous reactors. (auth) 466 references.

MATERIALS TESTING

1721
North American Aviation, Inc.
HIGH TEMPERATURE COMPRESSION TESTS ON GRAPHITE, by L. Green. Issued Jan. 7, 1952. 18p. (NAA-SR-165)

Experiments on the compression of graphite cylinders at temperatures up to about 2600°C are described. It is found that the short-time compressive strength increases with temperature in the range from room temperature to 2000°C in a manner paralleling the tensile strength behavior. Typical stress-strain curves are presented, but the limited degree of experimental control dictated by the available test equipment makes the results only semi-quantitative in nature. The large, mutually opposing influences of temperature and strain rate are illustrated by photographs of typical failures. 9 figures. (auth)

1722
Illinois Univ. Engineering Experiment Station
EUROPEAN RESEARCH ON THE BEHAVIOR OF MATERIALS AND EXPERIMENTAL STRESS ANALYSIS, by Thomas J. Dolan. Nov. 1951. 42p. (NP-3593)

This report summarizes briefly the principal impressions of each of 22 laboratories visited by the author in Sweden, England, Switzerland, and France during 1951. Laboratories visited included governmental, university, and industrial research laboratories engaged in studies of properties of materials and experimental methods of analyzing stresses or recording dynamic strain measurements. A brief summary at the end of the report lists a few general comments regarding the work being done in the four countries visited.

1723
General Electric Co.
METALLURGICAL INVESTIGATIONS FOR SELECTION OF MATERIALS SUBJECTED TO AN ENVIRONMENT OF LIQUID LEAD-BISMUTH ALLOY; FINAL REPORT, by R. C. Grassi and D. W. Bainbridge. Aug. 1949. 63p. (NP-3613; U10527)

1724
Designers for Industry, Inc.
REPORT ON TRIP TO HANFORD, WASHINGTON ON SEPTEMBER 24, 1951, by Archer W. Richards. Dec. 6, 1951. 12p. (NYO-3388)

Specifications for the application of polyethylene coating to concrete are discussed. Equipment and methods proposed are reviewed and the differences between two methods of flame spraying are summarized.

VACUUM SYSTEMS

1725
A PARALLEL-DUCT VALVE WITH PNEUMATIC CONTROL FOR A THERMAL EVAPORATION APPARATUS. Pierre Prugne. J. phys. radium 12, 66A(1951) Oct. (In French)

A vacuum valve remotely controlled by compressed air is described. The air forces a flexible membrane tightly over grills in the vacuum line. No bends or other obstructions are necessary. The valve has been applied in a vacuum evaporation system.

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

1726

THE STRUCTURE OF SINTERED BERYLLIA. G. Jaeger. Ber. deut. keram. Ges. 28, 14(1951). (In German)

An abstract of this paper appeared in Brit. Ceram. Abstracts, abst. 2713(1951) Nov.-Dec. and is reproduced here.

The sintering process of BeO was investigated by Duvez, Odell, and Taylor (J. Am. Ceram. Soc. 32, 1(1949)). They heated BeO of an exactly defined grain size and found that up to a certain limit the sintered product was the coarser the finer the initial grain size; the minimum porosity of 8% was found with an initial grain size from 5 to 7 μ. A photomicrograph, given by these authors, shows pores of a peculiar shape although these pores were not particularly mentioned in their article. Jaeger found that the grain sizes in the sintered products were approximately the same as reported by the Americans, and considered that the hollow spaces between the crystals of the sintered BeO are a characteristic of this oxide. E. Ryschkewitsch described these hollows but supposed that they were gas inclusions. Jaeger disagrees with this hypothesis, chiefly on account of their symmetrical crystallographic shapes. 6 figures.

GEOLOGY AND MINERALOGY

1727

Bureau of Mines

PROCESSES FOR RECOVERING VANADIUM FROM WESTERN PHOSPHATES, by Floyd H. Banning and R. T. C. Rasmussen. Dec. 1951. 44p. (BM-RI-4822)

Exploratory tests were made of several methods of treating vanadiferous ferrophosphorus. Attempts to separate vanadium as a carbide dross by saturating molten ferrophosphorus with carbon were unsuccessful. The method of treating vanadiferous ferrophosphorus that showed most promise and was tested to the greatest extent was the roast-leach process. The vanadiferous ferrosphosphorus is roasted with soda ash and salt and then water-leached to extract V and P. P is crystallized from the clarified leach solution as trisodium phosphate, and the primary crystals are freed of V by dissolving them in water and recrystallizing them. V is recovered from the P-free solution by hydrolysis as the V-pentoxide product, known commercially as red-cake. Results of the experiments indicate that up to 95% of the V and 96% of the P are extracted from the ferrophosphorus. In some tests, 85% of the V was recovered in the final red-cake product, and 87.4% of the V was recovered as trisodium phosphate. (auth)

1728

TORBERNITE IN MISSOURI FIRE CLAY. W. D. Keller. Am. Mineral. 37, 125-8(1952) Jan. - Feb.

Torbernite, $Cu(UO_2)_2P_2O_8 \cdot 12H_2O$, hitherto unreported from Missouri, has been found filling thin cracks in a fireclay deposit of Pennsylvanian age in the north-central fireclay district of Missouri. The torbernite occurs invariably in a thin coating or scales on the clay along relatively tight joints. Rarely is a torbernite film continuous with an area as much as 0.5 in^2. Usually tiny flakes are isolated, or the mineral forms tiny, flat, circular, scaly rosettes 0.5 mm or less in diameter. Mineralogical properties and x-ray-diffraction lines are given, and origin is discussed.

METALS AND METALLURGY

1729

Los Alamos Scientific Lab.

X-RAY AND NEUTRON DIFFRACTION STUDIES OF THE MBe_{13} INTERMETALLIC COMPOUNDS, by W. C. Koehler, Joseph Singer, and Arthur S. Coffinberry. Los Alamos Scientific Lab. and Oak Ridge National Lab. [nd] 4p. (AECD-3298; LADC-1088)

Single crystals of U-Be and Th-Be compounds of high Be content were oscillated on the Unicam S.25 goniometer through regions of the reciprocal lattice selected to include one or more points of the face-centered cell. The (531), (731), and (11.3.1) reflections were obtained on the first- and third-layer lines. Neutron diffraction of a powder sample of the U-Be compound was done at Oak Ridge on the apparatus of Wollan and Shull (Phys. Rev. 73, 830(1948)). The results of both investigations support strongly the generalization first made by Baenziger and Rundle (AECD-2506), that the cubic compounds which occur in high-Be alloys are face-centered, have the composition MBe_{13}, and are isomorphous with $NaZn_{13}$.

1730

Knolls Atomic Power Lab.

THE EFFECT OF QUENCH-AGING ON THE NOTCH SENSITIVITY OF STEEL, by J. R. Low, Jr. [nd] 15p. (AECU-1839)

Charpy impact-test specimens of a semi-killed 1020 steel were quenched from 690°C and aged at room temperature for periods up to three years. During this period the transition temperature increased from −40°C to 0°C. Over-aging at 350°C, either immediately following quenching or after three years' aging, lowers the transition temperature to −15°C. It is suggested that quench-aging is responsible for the commonly observed brittle zone adjacent to welds in this grade of steel and that a low temperature post-heat treatment similar to that used for over-aging should improve the low temperature ductility of welded structures made of this and similar grades of steel. It is also shown that a decrease in the cooling rate from 690°C raises the transition temperature; this effect is believed to account for the fact that as-rolled plates show an increase in transition temperature as the thickness increases. (auth)

1731

Los Alamos Scientific Lab.

THE SCALING BEHAVIOR OF METALS, by James T. Waber. [nd] 24p. (AECU-1854; LADC-1080)

An extensive amount of practical information concerning the scaling of metals has been accumulated during the past fifty years. A few of the reasonable generalizations are given which have been derived from this information, together with facts which appear to be anomolous. In metal-scaling research, four definite scale-growth laws have been accepted. In the order of their decreasing frequency they are the parabolic, the linear, the logarithmic, and the cubic laws. These laws are discussed independently. In conclusion, the idea that the ratio of the oxide-to-metal volume indicates whether scaling should take place by one growth law or another has proved to be only partially successful. Temperature and time have profound effects upon scaling but are not yet clearly understood.

1732

Battelle Memorial Inst.

THE TITANIUM-MANGANESE, TITANIUM-TUNGSTEN, AND TITANIUM-TANTALUM PHASE DIAGRAMS, by R. I. Jaffee, L. W. Eastwood, D. J. Maykuth, R. M. Goldhoff, H. R. Ogden, J. W. Holladay, and J. G. Kura. June 1951. 60p. (AF-TR-6516(pt.1))

Investigations were carried out on the phase diagrams for the binary alloy systems of Ti-Mn, Ti-W, and Ti-Ta using both iodide titanium and Process A titanium metal bases. Work to date has largely been restricted to the

titanium-rich alloys prepared by arc melting. Studies were carried out, where possible, on alloy strip fabricated from the ingots by hot rolling. Metallographic, x-ray diffraction, and resistance-temperature methods were used in the investigation, and tentative diagrams for the three alloy systems have been constructed from these data. (auth)

1733

Institute of Engineering Research, Univ. of Calif.

THE NATURE OF THE CREEP CURVE; NINTH TECHNICAL REPORT, by T. H. Hazlett, E. R. Parker, and R. D. Hansen. Jan. 1952. 22p. (COO-55)

Experimental data have been obtained on the effects of stress, temperature, alloying, and grain structure on the creep characteristics of Ni. Related data on Ni-Ti alloys and Zn single crystals are included. The following conclusions are indicated. The creep rate for structurally stable metals tested under conditions of constant stress decreases continuously until the initiation of failure. There is no region of constant creep rate. The creep curve may be accurately represented by the empirical equation $\epsilon - \epsilon_0 = At^b$ in which ϵ = total true strain, ϵ_0 = instantaneous strain which occurs at the moment of loading, t = time, and A,b are constants. The parameter ϵ_0 is a quantity having real physical significance, denoting an instantaneous strain upon loading. The parameter A varies in a regular manner with stress, alloy content, and temperature. The parameter b also varies over a wide range, but the correlation of b with temperature, etc., will require many additional tests. The empirical equation is applicable to both single crystals and polycrystalline materials, indicating that the continuously decreasing creep rate is not solely a grain-boundary phenomenon. Accurate determination of the parameters A, b, and ϵ_0 requires strain measurements beginning at very short times after applying the load. In many cases readings must begin only seconds after loading.

1734

North American Aviation, Inc.

A VAPOR PRESSURE CHART FOR METALS, by R. L. Loftness. Issued June 1, 1951. 9p. (NAA-SR-132)

The plot of log p vs. 1/T for 52 metallic or refractory elements yields a family of straight lines which converge within a small region near 10,000 atmospheres and 10,000°C. (This is similar to the Cox chart for organic liquids.) Establishing an approximate convergence point permits useful estimation of the entire line up to 10,000°C for a metal, provided a single value of the vapor pressure is known at any temperature. Only Zn, Cd, Hg and Cs deviate substantially from the convergent line pattern of all the elements studied. (auth)

1735

National Bureau of Standards

CORROSION OF SURFACE TREATED ALUMINUM ALLOYS, by Fred M. Reinhart. May 25, 1951. 9p. (NBS-1004; U18492)

Panels of 24S-T3 AP alloy, surface-treated with Alrok 14 or Bonderite 170 and unpainted or painted with P-27 Zn chromate primer and Bakelite varnish, were exposed in a salt-fog cabinet to 20% NaCl at 95°F for 3 to 12 weeks, to tidewater for 6 to 24 months, and to a marine atmosphere at a 45° inclination E-SE for 6 to 24 months. The unpainted Alrok coating was the more resistant to corrosion from the tidewater and marine atmosphere. Alrok was susceptible to pitting; Bonderite showed intergranular attack. Both were good bases for the paint; however, elongations of the Bonderite specimens decreased considerably in tidewater after 24 months. (NRS abst.)

1736

Battelle Memorial Inst.

THE PLASTICITY OF MOLYBDENUM SINGLE CRYSTALS; TERMINAL REPORT; JANUARY 1, 1950 TO JUNE 15, 1951, by N. K. Chen and R. Maddin. June 21, 1951. 25p. (NP-3573; U20132)

Work was directed toward determining whether plastic deformation occurred on slip planes having the highest resolved shear stress or on the planes of highest atomic density. The effect of the temperature at which the material was tested was also studied. Good yields of single crystals of ⅛-in. Mo were obtained by a modified Andrade method (J. Metals (N.Y.),(1951) June). Mo single crystals were studied to determine the operative slip planes and lattice reorientations after plastic extension at room temperature. The crystals slip on the planes {110} in the direction ⟨111⟩. The behavior of Mo single crystals appears inconsistent with Andrade's theory. The highest-atomic-density theory partially explains the plastic behavior of Mo single crystals. Stereographic analysis of the asterism resulting from plastic deformation yielded highly reproducible results.

1737

Horizons, Inc.

THE PRODUCTION OF ZIRCONIUM BY FUSED SALT ELECTROLYSIS; TECHNICAL PROGRESS REPORT, SECOND QUARTER, SEPT. 1 TO NOV. 30, 1951, by Merle E. Sibert and Morris A. Steinberg. Jan. 1, 1952. 41p. (NYO-3117)

Progress is reported in the development of a process for the production of pure Zr metal by the electrolysis of K fluozirconate in a medium of fused Na chloride under an inert atmosphere. Complete descriptions of equipment used are included and an appendix describing analytical techniques is attached.

1738

Columbia Univ.

ELECTROLYTIC CUTTING OF METALS, by George L. Kehl and Irving Moch, Jr. Nov. 1, 1951. (NYO-3166)

A method is described which is suitable for cutting cylindrical specimens electrolytically for the primary purpose of securing metallographic specimens of irradiated metals and alloys. The principles involved are directly applicable to general cutting problems where conventional machine methods are not suited. Attention was directed mainly to cathode design in an attempt to produce a cut comparable to that secured by conventional cutting methods. Data are given on the quality of cut secured on a low-carbon steel specimen anode as a function of five different cathode assemblies. Of the five designs, the cathode-auxiliary anode assembly produced the best cut.

1739

SUPERCONDUCTIVITY OF VANADIUM. Aaron Wexler and William S. Corak. Phys. Rev. 85, 85-90(1952) Jan. 1.

The presence of small quantities of oxygen and nitrogen in interstitial positions in the vanadium lattice is found to affect markedly the superconductive properties of the metal. X-ray evidence supports the supposition that these impurities set up internal strains which are known to give rise to properties very similar to those of the hard superconductors. It is suggested that these strains, which, unlike those arising from mechanical work, are not always removable by vacuum heat treatment, are responsible for the difficulties associated with the preparation of samples of the metals exhibiting a reversible B, H curve. It is shown that the sharp penetration fields for a relatively pure specimen are probably not very different from the equilibrium fields. The transition temperature of V is 5.13°K, $(dH_c/dT)T_c = 436 \pm 20$ oersteds/deg, and the Sommerfeld $\gamma = 15 \times 10^{-4}$ cal/mole deg K_1. (auth)

1740
CAST MOLYBDENUM OF HIGH PURITY. G. W. P. Rengstorff and R. B. Fischer. J. Metals 4, 157-60(1952) Feb.

The effect of impurities on the bend ductility of cast Mo is reported. High-purity Mo was prepared by remelting under high vacuum. The ductility of "transverse-grain" specimens indicated that intergranular brittleness decreased with an increase in purity of the metal.

1741
EFFECT OF COLD WORK AND ANNEALING ON THE THERMOELECTRIC POWER OF MOLYBDENUM. J. Howard Kittel. J. Metals 4, 196(1952) Feb.

Observations are reported on the recovery process in cold-worked Mo as determined by changes in the thermoelectric power which occur as the metal is annealed. The measurements were made on commerically pure Mo wires which, after annealing at 1035°C in dried H_2 for 1 hr, were swaged to give a series of reductions up to a maximum of 84.5%. Graphs are given showing the thermoelectric power between annealed and cold-worked Mo as a function of the degree of cold work. The effect of annealing is also shown.

1742
DELAY TIME FOR THE INITIATION OF SLIP IN METAL SINGLE CRYSTALS. I. R. Kramer and R. Maddin. J. Metals 4, 197-203(1952) Feb.

The delay time for the initiation of slip was studied in single crystals of α brass, aluminum, and β brass. A delay time for slip was found in β brass when the specimens were tested below room temperature; however, one was not found for α brass or aluminum. A general theory for the existence of the brittle transition temperature is proposed. (auth)

1743
THE RECRYSTALLIZATION TEXTURE OF DRAWN ALUMINIUM WIRE. J. Sawkill and N. Thorley. Phil. Mag. (7) 42, 1369-72(1951) Dec.

The recrystallization texture of high purity (99-995%) cold-drawn Al wire has been found to be double, viz., [322], [100]. The [100] component is relatively weak. The scatter in the major [322] component increases, and the amount of the [100] component decreases, the higher the temperature of anneal. (auth)

TRACER APPLICATIONS

1744
THE ISOTOPE GEOLOGY OF OXYGEN. Sol R. Silverman. Geochim. et Cosmochim. Acta 2, 26-42(1951)

Natural silicates vary in their O^{18}/O^{16} ratios by as much as 2.4%. This difference is largely due to an exchange reaction between silica and water during the processes of erosion and sedimentation, as a result of which sedimentary rocks are richer in O^{18} than are the igneous rocks. The temperature coefficient for the silica-water exchange has been estimated to be -0.0128% per °C. The O^{18} content of basic igneous rocks is low and confined to a narrow range (0.64 to 0.70%). The alkalic and granitic igneous rocks are richer in O^{18}, and their isotopic ratios are more variable 0.77 to 1.22%. In granitic rocks, quartz shows a greater preference for O^{18} than does orthoclase; the distribution coefficient is 1.20 in favor of the quartz. The isotopic constitution of stony meteorites is identical to that of the basic igneous rocks, but tektites resemble the sedimentary rocks in their isotopic composition. The analysis of a granophyre-gabbro sequence revealed an isotopic gradient which suggests solid diffusion as the mode of origin for the intermediate rock. The mechanism of metamorphism has been studied from the standpoint of isotopic composition. The results are not conclusive, but suggest that metamorphism is associated with a depletion of O^{18}. (auth)

PHYSICS

1745
Massachusetts Inst. of Tech.
STUDY OF HELIUM DIFFUSION THROUGH ALUMINUM, by P. Gordon, J. E. Atherton, Jr., and A. R. Kaufmann. [nd] Decl. with deletions Feb. 12, 1952. 9p. (AECD-3313; MIT-1075)

An outline is given of a method for the measurement of He diffusion through a thin Al diaphragm. No diffusion of He through 2S Al at temperatures up to 500°C was observed, using a mass spectrometer leak detector capable of detecting 1.8×10^{-10} standard cc/sec/cm^2.

1746
Brookhaven National Lab.
QUARTERLY PROGRESS REPORT; JULY 1 - SEPTEMBER 30, 1951 (Unclassified Section). [nd] 162p. (BNL-132)

Separate abstracts have been prepared on the following sections of this report: Physics, Instrumentation and Health Physics, and Accelerator Project, p.1-64; Chemistry and Reactor Science and Engineering, p.65-130; and Biology and Medicine, p.131-162.

1747
Brookhaven National Lab.
PHYSICS, INSTRUMENTATION AND HEALTH PHYSICS, AND ACCELERATOR PROJECT, p.1-64 of QUARTERLY PROGRESS REPORT; JULY 1 - SEPTEMBER 30, 1951 (Unclassified Section). [nd] 64p. (BNL-132(p.1-64))

The report of progress by the Physics Department contains 33 items, most of which represent contributions for publication in the open literature. A series of tests of the effectiveness of the filter beds in removing specific radioactive substances from the BNL sewage effluent were completed and data are presented in tabular form. Data on testing of components of the Brookhaven synchrotron are given. It is reported that completion of the synchrotron is in sight.

1748
National Bureau of Standards
SUPERCONDUCTIVITY OF THE ISOTOPES OF TIN, by E. Maxwell. Nov. 26, 1951. 28p. (NBS-1344)

The superconducting transition temperatures of six samples of tin with masses ranging from 113.58 to 123.01 were measured by a magnetic method and found to obey a relation of the form $M^{0.505}T_c = \text{const}$. The critical field curves for the samples for mass 113.58, 118.05 and 123.01 were determined between 1.4 and 3.8°K and observed to be geometrically similiar to about 1 part in 800. From this it is concluded that the electronic specific heat in the normal state is independent of mass and that the thermodynamic functions derived from the critical field curves also have the similarity property. (auth)

1749
New York Univ.
FIRST QUARTERLY REPORT FOR MONTHS INCLUDING FEBRUARY, MARCH, APRIL ON RESEARCH OF FLUORESCENCE AND CONDUCTIVITY PHENOMENA, by Hartmut Kallmann, Director. May 1951. 71p. (NP-3581; U19981)

The Q (solvent) and R (solute) constants, describing quenching in molecules, increased for solutions of phenyl-α-naphthylamine in xylene, diphenylbutadiene in C_6H_6, and diphenylhexatriene in p-dioxane under α and γ excitation. Ag-activated irradiated NaCl crystals exhibited fluorescence of about the strength of anthracene crystals followed by strong phosphorescence which decayed slowly. At these low phosphorescence levels, irradiation with near-UV to red light produced strong UV emission in crystals pre-

irradiated with high-energy radiation; emission continued after removing the stimulating light to give about ⅓ of the amount emitted under the preceding γ irradiation. Preliminary studies were made of the influence of γ excitation and infrared (IR) stimulation on ZnCdS-type inorganic phosphors and alkaline-earth sulfides. Blue ZnS samples of long and short persistences were the most efficient fluorescent powders under γ radiation and were superior to anthracene. A long-persistent yellow ZnCdS gave smaller readings than the blue powders but were better in the red. Simultaneous IR and γ irradiation increased the light output, which then decreased slowly to about the original fluorescence. Fonda phosphors and the long-persistent ZnCdS had strong storage and stimulation properties, but a short-persistent yellow ZnCdS showed almost no stimulation properties. Current induced by UV light, fast electrons, α particles, and γ radiation was not always proportional to the intensity of exciting radiation because of the existence of unfilled electron traps. IR light applied in addition to or after removal of exciting radiation produced stimulating and quenching effects, but the relative amounts of the effects depended on the time of application. (cf. TIP U18814) (NRS abst.)

1750

Research Lab. of Electronics, Mass. Inst. of Tech.
QUARTERLY PROGRESS REPORT, by A. G. Hill, J. B. Wiesner, and G. G. Harvey. Jan. 15, 1952. 103p. (NP-3585)

Progress during this period on ionization-gage studies, microwave gaseous discharge, solid-state physics, low-temperature physics, microwave spectroscopy, molecular beam and magnetic properties research, magnetron and microwave tube development, communication research, and analog computer research is summarized. Published reports and journal articles covering the work are listed.

1751

Research Lab. of Electronics, Mass. Inst. of Tech.
EXPERIMENTAL STUDY OF NONLINEAR DEVICES BY CORRELATION METHODS, by L. Weinberg and L. G. Kraft. Jan. 20, 1951. 29p. (NP-3586; Technical Report No. 178)

The correlation technique is applied experimentally to determine the power density spectra of the output of two nonlinear devices, the linear and square-law rectifiers. Curves of the autocorrelation function obtained experimentally for inputs of filtered noise with and without a sine wave are compared with the theoretically calculated curves, and thus an experimental check on some known theoretical results is obtained. (auth)

1752

University Coll., London (England)
PROCEEDINGS OF THE CONFERENCE ON DYNAMICS OF IONIZED MEDIA. Apr. 1951. 164p. (NP-3611)

The papers presented were given at the conference on the Dynamics of Ionized Media held in the Physics Department of University College, London, Mar. 19-21, 1951. The program dealt with magneto-hydrodynamics, plasma oscillations, and the applications of these theories to problems dealing with such diverse topics as gas discharge, radiation from plasma, microwave tubes, magnetic storms and auroral and solar and cosmic radio noise. The report also includes the discussion which followed each talk.

1753

Radiation Lab., Univ. of Calif.
SUMMARY OF RESEARCH PROGRESS MEETING OF OCTOBER 25, 1951, by Sergey Shewchuck. Dec. 11, 1951. 9p. (UCRL-1606)

Heat of Reaction and Crystal Energy in High Temperature Hydrolysis of Some Solid Trichlorides, by B. B. Cunningham. A general type of reaction with H_2O vapor at high temperature is: MCl_3(solid) + H_2O(gas) → MOCL (solid) + 2HCl(gas) where M is any of the rare earth, transuranium or other elements which undergo this reaction. Two methods of determining the thermodynamic properties of the oxychlorides are discussed, the first from the heats of reaction obtained from the equilibrium constant K at various pressures and the second from crystal structure and energy. The values of crystal energy are given for $LaCl_3$ and LaOCl. Nuclear Momentum Distribution, by J. Cladis. A 35-channel magnetic particle spectrometer has been used to study the momentum distribution of protons scattered from C, D_2, and H_2. The schematics of the apparatus, data obtained at scattering angles of 30 and 40°, and data on the ratio of number of protons from D to the number from H are shown.

ASTROPHYSICS

1754

Institute for Nuclear Studies, Univ. of Chicago
NUCLEAR ABUNDANCES AND COSMOGONY, sect.III of NUCLEAR PHYSICS AND THE PHYSICS OF FUNDAMENTAL PARTICLES; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, SEPTEMBER 17 TO 22, 1951, by Jay Orear, A. H. Rosenfeld, and R. A. Schluter, eds. [nd] 13p. (NP-3591(sect.III))

G. Gamow discussed the evolution of the expanding universe. H. E. Suess reported evidence for shell structure in his attempts to fit the nuclear abundance data onto smooth curves by applying corrections to the experimental values. O. R. Frisch described the cosmogonical viewpoint which holds that the composition of the universe has always been the same, and that matter is being continuously created to keep the density of the universe the same even though it is expanding. L. Borst proposed that the origin of Li in cosmic radiation may be the generation of Be^7 from He in supernovae. G. Kuiper reported on recent determinations of the stellar nuclear abundances. H. S. Brown gave preliminary results on the abundance of heavy elements, in particular Pb and U. E. Salpeter discussed stellar nuclear reactions. He reviewed the present state of the p-p reaction vs. the Bethe cycle situation, nuclear processes in supernovae, and nuclear reactions which may take place in stars after the H is all converted to He. R. E. Peierls discussed an alternative process of the formation of the elements, in which the universe—initially at temperature 0°K., in contrast to what is proposed in Gamow's lecture—was completely filled by nuclear matter in the form of a polyneutron, with a possible proton composition of not more than about 10^{-5}. H. C. Urey spoke on the abundance of the elements and suggested that chondrites should be investigated in more detail as representing an average sample of the nonvolatile material from which the planets evolved.

1755

THE PRIMEVAL LEAD ISOTOPIC ABUNDANCES AND THE AGE OF THE EARTH'S CRUST. Ralph A. Alpher and Robert C. Herman. Phys. Rev. 84, 1111-14(1951) Dec. 15.

Nier's determinations of Pb isotopic abundances in common Pb ores have been the subject of considerable study in connection with attempts to calculate the age of the earth. The importance of the age of the earth in fixing the age of the elements has led the authors to remark on the very high precision frequently attributed to the former age determinations. A calculation is presented which yields a rough maximum age of the earth, namely, t(max) = 5.3 billion years. The primeval Pb isotopic abundances are estimated and briefly discussed in the light of nuclear systematics. (auth)

COSMIC RADIATION

1756

Engineering Research Inst., Univ. of Mich.

THE EFFECT OF ATMOSPHERIC TEMPERATURE VARIATIONS ON COSMIC-RAYS UNDERGROUND, by W. E. Hazen and Noah Sherman. Dec. 31, 1951. 81p. (NP-3580)

The variations in the intensity of cosmic rays observed underground, in a salt mine 1100 ft below the surface (846 mwe), are correlated with variations in temperatures in the stratosphere and at sea level, over the period from Apr. 1, 1951, to Nov. 30, 1951. The theoretical model describing the production of mesons, is developed on the basic assumption that μ mesons originate only in the decay products of π mesons, and this model is shown to indicate an expected temperature coefficient of ~0.4% per degree for μ mesons of energy $>10^{11}$ ev. The cosmic rays observed in the salt mine are μ mesons, with essentially this average energy, and their secondary products. The results given are considerably smaller than the predicted theoretical value and lie well outside the uncertainty inherent in the mathematical treatment of the π-μ decay model. It is, then, concluded that the π-μ decay model does not describe the origin of μ mesons of energy $>10^{11}$ ev. Consideration is given to the pertinent properties of hypothetical particles which could replace π mesons as the progenitors of μ mesons. In view of the recently discovered κ meson, which has been observed to decay into a μ meson, this particle is suggested as a possible parent of high-energy μ mesons.

1757

PENETRATING SHOWERS IN COPPER. P. C. Bhattacharya. Phys. Rev. 84, 1052-3(1951) Dec. 1.

The penetrating showers produced by cosmic radiation in Cu have been studied at Ottawa (altitude 300 ft) by means of G-M counters in 5-fold coincidence. The counter arrangement is shown, and the results of a 5-month continuous observation of dependence of penetrating showers on thickness of Cu are tabulated and plotted as transition curves. The transition curve for extensive showers gives an indication of a cascade-type maximum, showing that in air showers electrons are present along with groups of penetrating particles and that these electrons are responsible for the slight increase in shower intensity. The position of this maximum is near 6- to 7-cm copper corresponding to 4 cascade units. The curve for local showers shows a marked transition effect with signs of a saturation in the vicinity of 80 to 120 g/cm^2 of Cu.

1758

PRIMARY SPECIFIC IONIZATION OF COSMIC RAYS IN HYDROGEN. M. H. Shamos and I. Hudes. Phys. Rev. 84, 1056-7(1951) Dec. 1.

Experiments have been performed to test the dependence of primary specific ionization upon momentum for high-energy particles. The technique used involves the unique dependence of the efficiency of a counter, operating in the Geiger region, upon the primary specific ionization. The efficiency of a low-pressure H_2-filled counter was measured at sea level and under ~140 feet of rock. The average momentum of the sea-level cosmic radiation is ~3500 Mev/c, while the average momentum under 140 feet of rock is ~48,000 Mev/c. The ratio of the primary specific ionization underground (J_{140}) to that at sea level (J_0), computed from the measured efficiencies, is $(J_{140}/J_0)_{exp} = 1.17 \pm 0.03$. Theoretical values computed for J from Bethe's theory and the meson momentum distribution are in excellent agreement with the experimental value.

1759

THE DISTRIBUTION OF MULTIPLICITIES OF NEUTRONS PRODUCED BY COSMIC-RAY μ-MESONS CAPTURED IN LEAD. Marshall F. Crouch and Robert D. Sard. Phys. Rev. 85, 120-9(1952) Jan. 1.

The nature of the μ-meson capture process in Pb has been investigated by studying the number of neutrons emitted by the excited nucleus. Working under 2000 g cm^{-2} of clay and limestone and a 144 g cm^{-2} Pb filter, events were studied in which a single charged particle penetrated a triple-coincidence telescope and stopped in an 86 g cm^{-2} Pb absorber, with one or more delayed coincident neutron counts from an array of ten $B^{10}F_3$ counters in a paraffin moderator placed below the absorber. On the basis of 327 delayed-neutron coincidences, the mean multiplicity of disintegration neutrons per stopped negative μ meson was found to be 2.16 ± 0.15, with $\pm 10\%$ additional error due to the uncertainty in the strength of the standard neutron source used to determine neutron detecting efficiency. The mean squared multiplicity was found to be 5.2 ± 1.9 on the basis of 3 double-neutron coincidences. On the evaporation model the expected mean multiplicity for 100-Mev excitation energy is about 6, while a calculation based on the $\mu^- + P \rightarrow N + \nu$ hypothesis, using the distribution of excitation energy calculated on the free-particle model and Weisskopf's statistical theory of the nucleon-evaporation process, leads to an expected mean multiplicity of 0.95.

1760

NUCLEAR INTERACTIONS OF COSMIC RAYS IN A SILVER CHLORIDE CRYSTAL. Frederick C. Brown and J. C. Street. Phys. Rev. 84, 1183-9(1951) Dec. 15.

A disk of AgCl, cut from a large crystal grown by slowly cooling the melt, was operated as an ionization detector at sea level and at Climax, Colorado, elevation 11,200 ft. Calibration was achieved by testing the response of the crystal to single cosmic-ray particles ionizing near minimum. By means of a Geiger counter coincidence system stars produced in the crystal by ionizing particles (protons) were separated from those produced by non-ionizing particles. A pulse-height distribution is plotted for the larger pulses and is in approximate agreement with star data from photographic emulsions for energy releases in the crystal of greater than 80 Mev. Electron showers and slow protons which stop in the crystal are shown to contribute to the rates below this energy. An apparent absorption thickness in air of 114 ± 5 g/cm^2 is obtained for the ionizing star-producing radiation between Climax and sea level. By assuming a geometrical cross section for interaction in the crystal, the intensity of energetic protons at Climax is estimated to be approximately 10% of the hard component. (auth)

1761

OBSERVATIONS ON SOME HIGH ENERGY COSMIC-RAY COLLISIONS IN PHOTOGRAPHIC EMULSIONS. E. Pickup and L. Voyvodic. Phys. Rev. 84, 1190-8(1951) Dec. 15.

A brief account is given of some high-energy disintegrations initiated in photographic emulsions by primary cosmic-ray particles at about 90,000 ft above sea level. In particular, six events which show only relativistic or near-relativistic fragments and a typical forward cone of shower particles are described in detail. The angular distribution of the shower particles is, in some of these cases, consistent with them, being due to the multiple production of mesons in a single interaction between an incoming nucleon and a H nucleus, or a nucleon on the edge of a heavier nucleus, according to the mechanism of Fermi's recent theory. One of these events has thus been interpreted as a collision between an incoming Li nucleus with an energy of about 2×10^{12} ev per nucleon and a H nucleus in the emulsion. (auth)

1762

A DEDUCTION OF THE HIGH ENERGY SPECTRUM OF COSMIC-RAY PRIMARY NUCLEONS FROM THE OBSERVED

MUON SPECTRUM. Uri Haber-Schaim. Phys. Rev. 84, 1199-1203(1951) Dec. 15.

Fermi's theory of pion production is extended to treat collisions of nucleons with air nuclei. The energy distribution of the created pions and their daughter muons is calculated approximately, and is applied to correlate the observed muon spectrum in the energy range 10–100 Bev with the primary nucleon spectrum. The results and limitations of this procedure are discussed. (auth)

1763

ZENITHAL DISTRIBUTION OF COSMIC RADIATION. André G. Voisin Can. J. Phys. 29, 505-17(1951) Nov. (In French)

Zenithal distribution of the penetrating component, principally μ mesons at ground level, has been studied. Two contiguous bands were selected in the differential spectrum; the momenta of the registered particles (mesons) extended from 300 to 410 and from 410 to 510 Mev/c, respectively. The distribution in intensity observed for zenithal angles between 0 and 180° is reported. The distribution law of the particles studied is shown to be different from the zenithal distribution of the integral spectrum.

1764

IONIZING POWER OF COSMIC RAY PARTICLES AT SEA LEVEL. S. D. Chatterjee. Can. J. Phys. 29, 495-504(1951) Nov.

Using a proportional counter telescope arrangement, experiments have been carried out at sea level to explore the nature and ionizing power of particles in the soft component of cosmic radiation and those produced under 1.8 cm and 20 cm of lead. The results indicate a preponderance of relativistic electrons in the soft component and under 20 cm of lead. Under 1.8 cm of lead there is some disagreement with the calculated pulse height distribution curve but this can be attributed to the production of showers in the lead. These showers would obscure the presence of a small number of particles of unusually high ionizing power, if such exist. (auth)

1765

ELECTROMAGNETIC CASCADES IN PHOTOGRAPHIC EMULSIONS. J. E. Hooper, D. T. King, and A. H. Morrish. Can. J. Phys. 29, 545-56(1951) Nov.

Photographic emulsion techniques are described for observation and identification of electromagnetic processes which occur in the soft component of the cosmic radiation. Several cascade showers are illustrated and measurements on these are discussed in the light of theoretical predictions. (auth)

1766

SOME FEATURES OF NUCLEAR DISINTEGRATIONS CAUSED BY COSMIC RAYS. P. E. Hodgson. Phil. Mag. (7) 43, 190-200(1952) Feb.

Cosmic ray stars in light and heavy elements have been investigated by the photographic plate method. The angular distribution of the particles from stars in heavy elements is shown to be isotropic, while that of those from light elements is not. Possible explanations of this are discussed. The numbers of stars with various numbers of α particles and protons are shown to be in accordance with a random distribution. This indicates that the emission of one charged particle has no influence on the nature of a subsequent charged particle. The emission of excited Be^8 nuclei is also investigated and their frequency found to agree with the evaporation theory. (auth)

1767

A 27-DAY VARIATION IN THE HARD COMPONENT OF COSMIC RADIATION AND THE EARTH'S MAGNETIC FIELD AT MINIMUM SOLAR ACTIVITY. Herma Gheri. Z. Naturforsch. 6a, 775-80(1951) Dec. (In German)

Observation on 23 solar rotations indicates that only a small portion of the 27-day variation can be explained as an effect of the earth's magnetic field. Frequency-distribution peaks in the magnetic correction were found at 1 to 6 days during 12 rotations and at 9 to 11 days during 5 rotations. In the first case, the importance of the time of the magnetic recurrence was noted, as well as the variation in surface temperature and radiation; explanation of the variation as resultant atmospheric effects may be possible. No explanation was found for the 9-to-11-day maximum.

ELECTRICAL DISCHARGE

1768

Research Lab. of Electronics, Mass. Inst. of Tech.

ELECTRON DENSITY DISTRIBUTION IN A HIGH FREQUENCY DISCHARGE IN THE PRESENCE OF PLASMA RESONANCE, by W. P. Allis, Sanborn C. Brown, and Edgar Everhart. July 16, 1951. 9p. (NP-3558; Technical Report No. 210; U20228)

In a high frequency discharge, plasma resonance maximizes the electric field, thus producing a high ionization rate in the regions near resonance. The effect on the distribution of electrons and of ionization in a parallel plane discharge is calculated and compared with the observation that the light from such a discharge often is a minimum at the center. (NRS abst.)

ELECTRONS

1769

Duke Univ.

ON THE CALCULATION OF ELECTRONIC LEVELS IN PYRIDINE AND THE ISOMERIC PICOLINES, sect.4 of TECHNICAL REPORT NO. 6, by Gertrud P. Nordheim and H. Sponer. Dec. 20, 1951. 11p. (NP-3592(sect.4))

Electronic levels in pyridine and the picolines were calculated by the molecular-orbital method. Perturbation parameters δ_k were introduced into the secular determinant at the appropriate positions to account for changes of the C_6H_6 Coulomb integrals caused by the N atom in the ring and by CH_3 substitution. Bonding and antibonding single-electron molecular orbitals were obtained by neglecting the overlap integral and electron repulsion. Average heights were determined for 4 one-electron transitions corresponding to the 4-fold degenerate level in C_6H_6. Centers of gravity (c.g.) were predicted for pyridine and the picolines by means of 2 different perturbation parameters under the assumption that the c.g's of the actual singlets are proportional to the average heights of the 4-fold degenerate level. A pyridine value of 6.12 ev for the predicted average height of the actual levels agreed with the experimentally observed mean of 6.14 ev. Corresponding values of 6.25, 6.07, and 6.09 ev were calculated for α-, β-, and γ-picoline. (NRS abst.)

1770

Research Lab. of Electronics, Mass. Inst. of Tech.

PROPAGATION OF DISTURBANCES IN ACCELERATED ELECTRON STREAMS; I. ONE-DIMENSIONAL ACCELERATED STREAMS, by L. D. Smullin. July 12, 1951. 6p. (NP-3599; Technical Report No. 207; U20024)

The propagation of small sinusoidal modulations in the infinite, parallel-plane diode was studied. A second-order differential equation was obtained for the alternating convection current. Solutions were found in closed form for the cases of a drift-stream, space-charge-limited acceleration, and acceleration with an arbitrary current density less than the space-charge-limited value. (NRS abst.)

1771

Carnegie Inst. of Tech.

THREE-QUANTUM ANNIHILATION AND POSITRONIUM, by S. DeBenedetti and R. Siegel. Nov. 23, 1951. 7p. (NYO-914)

The three-quantum annihilation of positrons stopping in solids and gases has been detected by means of a triple coincidence method. The formation of positronium in Freon has been confirmed, and the spectrum of the three-quantum annihilation radiation has been measured for the symmetric arrangement of the counters. (auth)

1772
THE DIAMAGNETISM OF FREE ELECTRONS. E. H. Sondheimer and A. H. Wilson. Proc. Roy. Soc. (London) 210A, 173-90(1951) Dec. 20

A rigorous formulation is given of the quantum theory of the diamagnetism of free electrons. It is shown that Z, the partition function in classical statistics, may be calculated for arbitrary magnetic fields and temperatures without explicit knowledge of the energy levels, and complicated arguments involving boundary electrons are therefore unnecessary. It is further shown that the phenomena which arise in Fermi-Dirac statistics are determined by the singularities of Z regarded as a function of a complex variable, and, in particular, that the poles of Z give rise to the de Haas-van Alphen effect (the periodic field dependence of the susceptibility at low temperatures). The theory confirms the results obtained in earlier treatments. (auth)

GASES

1773
Los Alamos Scientific Lab.
EQUATION OF STATE OF GASES AT HIGH TEMPERATURES, by Harry Milton Peek and Zevi W. Salsburg. [nd] 4p. (AECD-3297; LADC-1091)

Integration of the following equation will give the equation of state of the detonation products of gaseous explosions:

$$\rho^2\left(\frac{\partial E}{\partial P}\right)_\rho \left(\frac{\partial \ln T}{\partial \rho}\right)_P + \left[P - \rho^2\left(\frac{\partial E}{\partial \rho}\right)_P\right]\left(\frac{\partial \ln T}{\partial P}\right)_\rho = 1$$

Here $P-P_0 = \rho_0 uD$, $\rho(D-u) = \rho_0 D$, $E-E_0 = \frac{1}{2}(P + P_0)\left(\frac{1}{\rho_0} - \frac{1}{\rho}\right)$, where u is the particle velocity of the detonation products, D the detonation velocity, P the pressure, ρ the density, and E the specific internal energy. The subscript zero refers to the initial state of the explosive. The problem of measurement of pressure and density of the product gases at the Chapman-Jouguet plane is discussed briefly. Experimental knowledge of these equations of state would provide useful thermodynamic data up to 5000°K and 10^4 atm.

1774
Los Alamos Scientific Lab.
RELATIONSHIPS BETWEEN TRANSPORT PROPERTIES OF GASES, by E. R. Grilly. [nd] 11p. (AECU-1860; LADC-1090)

Using reliable data on thermal conductivities (K), viscosities (η), and specific heats (c_v), values of the important ratio $f=K/\eta c_v$ have been determined over a wide range of temperature, 80 to 380°K, for H_2, He, O_2, CO, NO, CO_2, N_2O, and CH_4. For some gases the ratio shows a decrease with increasing temperature and for others, an increase. The results and existing theories do not agree on all points. For a monatomic gas, He, f has a constant value up to 250°K, agreeing with most theories, but it drops at higher temperatures. One diatomic gas, H_2, shows a sharp drop, agreeing very well with Eucken's theory. Another diatomic gas, NO, shows a rise much sharper than predicted by the theory. Other diatomic and polyatomic gases show large deviations from Eucken's theory, mainly in that experimental values rise while the theory predicts a decrease with increasing temperature. (auth)

1775
THE THERMO-OSMOSIS OF GASES THROUGH A MEMBRANE. I. THEORETICAL. K. G. Denbigh and Gertrud Raumann. Proc. Roy. Soc. (London) 210A, 377-87(1952) Jan. 7.

The process of thermo-osmosis is the passage of a fluid through a membrane due to a temperature gradient. Under suitable conditions it gives rise to a stationary difference of pressure. The thermo-osmosis of a gas through a membrane in which it is slightly soluble is due partly to the temperature coefficient of its solubility and partly to the existence of a thermal diffusion process inside the membrane. A theory is developed on the basis of Onsager's treatment of irreversible processes and leads to equations giving the rate of permeation and the pressure ratio at the stationary state. The magnitude of the effect depends on the algebraic sum of the heat of solution and the heat of transport within the membrane. (auth)

1776
THE THERMO-OSMOSIS OF GASES THROUGH A MEMBRANE. II. EXPERIMENTAL. K. G. Denbigh and Gertrud Raumann. Proc. Roy. Soc. (London) 210A, 518-33 (1952) Jan. 22.

An apparatus is described for the measurement of the thermo-osmotic effect of CO_2, N_2, H_2, and water vapor through a natural rubber membrane. The existence of the effect is demonstrated in all four cases. The experimental results are in accord with the theoretical expressions of part I concerning the rate of penetration through the membrane and the pressure ratio at the stationary state. The calculated values of the heat of transport are discussed with special reference to a molecular-kinetic theory of diffusion in quasi-crystalline lattices. (auth)

INSTRUMENTS

1777
Oak Ridge National Lab.
VOLTAGE REGULATOR FOR ELECTROPLATING CONTROL, by L. B. Rogers and C. B. Pickle. Dec. 23, 1946. Decl. Feb. 1, 1952. 13p. (AECD-3310; MonP-257)

Specifications, circuit diagrams, and operating instructions for a voltage regulator to be used in precise cathode-potential regulation in electroplating are presented.

1778
Los Alamos Scientific Lab.
ELECTRON RADIOGRAPHY, by Arthur I. Berman. Dec. 5, 1950. 51p. (AECU-1853; LADC-993)

Electron radiography is considered both theoretically and empirically as a method of analysis essentially of thin biological sections, and polished metallurgical surfaces. Comparative illustrations are shown of this and complementary techniques using soft x rays and visible light; the scope and limitations of each are cited. (auth)

1779
[Los Alamos Scientific Lab.]
COLD-CATHODE THYRATRON SCALERS, by Curtis Sewell, Jr. [nd] 26p. (AECU-1861; LADC-591)

1780
Knolls Atomic Power Lab.
IMPROVED PRECISION EQUIPMENT FOR METALLURGICAL ANALYSIS, by L. L. Wyman. Nov. 15, 1951. 69p. (KAPL-654)

A report is given on the development and operation of the differential transformer for use as a sensitive element of a dilatometer. The resulting instrument is a direct-reading, instantaneous, and constant-curve-drawing temperature-

expansion recorder. A thermal-resistance unit and an automatic thermo-critical point recorder are described.

1781

Research Lab. of Electronics, Mass. Inst. of Tech.

AN FM-AM MULTIPLIER OF HIGH ACCURACY AND WIDE RANGE, by Robert Price. Oct. 4, 1951. (NP-3559; Technical Report No. 213; U20226)

This multiplier employs combined frequency and amplitude modulation to obtain nearly faithful multiplication with minimum space requirements. With a fixed d-c signal on either input, linearity of the output with the other input is within 1 or 2%. The range in output product is 2500:1, the output for maximum input signals of 1.4 v in the f-m channel and 5.6 v in the a-m channel being 0.07 v. Frequency response is excellent from d-c up to 5 kc in either channel. At 10 kc there is about 7° phase shift in the a-m channel, with the same performance in the f-m channel if the automatic frequency control phase-correcting unit is used. Total chassis space is about 1.5 sq.ft. (NRS abst.)

1782

Columbia Radiation Lab., Columbia Univ.

PROGRESS REPORT; THIRD QUARTERLY REPORT FOR THE YEAR 1951. Sept. 30, 1951. 19p. (NP-3602; U20187)

The performances of tubes utilizing pure metal and "L"-type oxide cathodes and designed for the generation of high frequencies are reported. A line frequency multiplier was designed which provides 120, 240, 480, and 960 cps sine-wave output signals for triggering a synchroscope. A proton resonance standard for magnetic fields was developed. A Pound (IF) frequency stabilizer for a 2K50 klystron was constructed using a stabilizing cavity having an unloaded Q of 10,000. The cavity may be slowly varied in frequency to sweep slowly over weak microwave lines. The spectrum of BrCN at room temperature was qualitatively examined. The quadrupole resonant line of Cl^{35} in crystal CH_2Cl_2 at liquid N temperature was observed at ~36 Mc.

1783

New Mexico Univ.

FREQUENCY MODULATED AUDIO OSCILLATORS (thesis), by James L. Dossey. 1951. 79p. (NP-3624)

With increasing demands for larger quantities of accurately telemetered information, as in FM-FM air-to-ground telemetering systems, more exacting specifications are being placed on the design of the subchannel oscillator. It was the purpose of this study to evaluate existing oscillator circuits, to produce a more satisfactory oscillator, and, finally, once a desirable circuit was found, to obtain such refinements as simplicity of alignment, interchangeability of tubes, better frequency stability by utilizing proper mechanical design, and smaller, cheaper parameters without sacrificing performance.

1784

Pennsylvania State Coll.

A LINE DIVIDER AS AN AID IN CALCULATING GRAPHS, by Aaron J. Martin. Sept. 10, 1951. 5p. (NYO-850; Report No. 12)

A device is described which can rapidly and accurately divide a straight line into equal parts for use as an aid in calculating graphs, e.g., polarograms. Appropriate slots are cut through a plastic triangle upon which parallel lines are scribed. The absolute error of measurement is less than 0.02 cm. (auth)

1785

A FREQUENCY CONTROLLER FOR REFLEX KLYSTRONS. Edward S. Dayhoff. Rev. Sci. Instruments 22, 1025-26(1951) Dec.

A frequency stabilizing arrangement for a reflex klystron consists of a frequency-sensitive element to measure the frequency error, an amplifier to amplify this error signal and a d-c level changer to transfer the resulting frequency correcting signal from the low d-c voltage level of the amplifier to the frequently much higher level of the klystron repeller. The design and advantages of this circuit are discussed.

1786

POTENTIOMETRIC COMMUTATOR FOR THE MEASUREMENT OF CONTINUOUS VOLTAGES. C. Van Blitz and J. Weill. J. phys. radium 12, 78A-80A(1951) Oct. (In French)

The apparatus uses an automatically controlled telephone rotary commutator and permits, by a balancing method, a precise measurement of either constant or slowly varying continuous voltages. Application to measurement of the power of a nuclear reactor by following the output of an ionization chamber is described.

1787

INVESTIGATION OF THE RESPONSE OF A BOLOMETER SUBJECTED TO MODULATED RADIATION. M. Surdin. J. phys. radium 12, 37A-40A(1951) Oct. (In French)

A theoretical study of the alternating efficiency of a bolometer exposed to modulated thermal radiation shows the importance of the cooling-period constant. The conclusions are confirmed by experimental studies on a bolometer consisting of a cathode deposit of Pt on mica.

1788

A THEORY OF ELECTRICAL FLUCTUATIONS IN SEMICONDUCTORS. M. Surdin. J. phys. radium 12, 777-83 (1951) Oct. (In French)

When a constant current flows in a semiconductive filament or in a crystal detector in contact with metal, electrical fluctuations are observed at the junctions which have an intensity many powers of 10 greater than the fluctuations caused by the thermal or shot effects. A proposed theory is based on the fluctuations in the case of the filament and on the number of "donor centers" in the potential barrier in the case of the metal-semiconductor contact.

1789

A HIGH-VOLTAGE PILE OF SMALL VOLUME. P. Bristeau. J. phys. radium 12, 74A-78A(1951) Oct. (In French)

A high-voltage battery of the Zamboni-type pile is described. Fabrication and stability of the Sn-$ZnCl_2$-MnO_2-C pile are discussed. Several applications to radiation-detection instruments are suggested.

ISOTOPES

1790

Radiation Lab., Univ. of Calif.

METHODS OF PRODUCING RADIOIRON, PARTICULARLY HIGH SPECIFIC ACTIVITY Fe^{59}, by Rayburn W. Dunn. Nov. 30, 1951. 34p. (UCRL-1589)

Possible methods of production of radioiron by deuteron, proton, or neutron reactions, as well as methods in actual use, are discussed, and a detailed description is given of the procedure employed for the preparation of high-specific activity Fe^{59} by the cyclotron (d,2p) reaction. Included are procedures for the purification and electroplating of Co, preparation of the probe target, removal of the radioactive material from the target after bombardment, radiochemical separation of the Fe from Co, and preparation of the purified material for medical use. Quantitative data are given on the yields and specific activities of samples from various sources, and from several cyclotron bombardments. The (d,2p) reaction produces about 0.07 μc per μa hr of 20-Mev deuterons in the 60-in. Berkeley cyclotron. The

specific activity of the product is of the order of 3 to 10 μc per μg; the maximum achievable specific activity is estimated to be around 100 μc per μg with a 100-hr bombardment at beam currents of 200 μa. (auth)

ISOTOPE SEPARATION

1791

Oak Ridge National Lab., Y-12 Area

A SURVEY OF CALUTRON CHARGE MATERIALS FOR STABLE ISOTOPE SEPARATIONS, by C. P. Keim. Nov. 14, 1951. Decl. with deletions Feb. 1, 1952. 9p. (AECD-3309; Y-822)

The best charge materials, source-oven temperature ranges, and collector materials used in calutron separation of the isotopes of Li, Be, B, C, N, O, Mg, Si, S, Cl, K, Ca, Ti, V, Cr, Fe, Ni, Cu, Zn, Ga, Ge, Se, Br, Rb, Sr, Zr, Mo, Ag, Cd, In, Sn, Sb, Te, Ba, La, Ce, Nd, Sm, Hf, W, Re, Hg, Tl, and Pb are tabulated.

MASS SPECTROGRAPHY

1792

Brookhaven National Lab.

THE ISOTOPIC ANALYSIS OF HYDROGEN IN VARIOUS COMPOUNDS, by Jacob Bigeleisen, M. L. Perlman, and H. C. Prosser. [nd] 6p. (BNL-1058)

In the isotopic determination of H by mass spectrometry, limitations on the ease of conversion, the size of sample required, the fact that an accurately known equilibrium state must be attained, the interference of foreign gases present in the sample or spectrometer, and the complexity of ion pattern may be minimized for a variety of hydrogenous compounds by reacting with hot metallic U. Results obtained by this method for H_2O, NH_3, PH_3, H_2S, C_2H_5OH, and C_3H_8 are tabulated, with observations on "memory" effects and stoichiometry.

1793

Institute for Nuclear Studies, Univ. of Chicago

MASS SPECTROSCOPY, sect.IIA of NUCLEAR PHYSICS AND THE PHYSICS OF FUNDAMENTAL PARTICLES; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, SEPTEMBER 17 TO 22, 1951, by Jay Orear, A. H. Rosenfeld, and R. A. Schluter, eds. [nd] 19p. (NP-3591(sect.IIA))

A. O. Nier reviewed recent developments in mass spectroscopy, and, in more detail, his own work at the University of Minnesota. In discussing the use of the mass spectrometer to measure atomic masses he briefly described several instruments and the resolution obtained with each. The results of Nier's measurement of the mass C^{12} by the "sulfur" method and his determination of the secondary standards H^1, C^{12}, and $C^{12}H_4$-O^{16} are compared with other recent determinations. Packing-fraction curves are shown and discussed. Nier described his work with the natural abundance of He^3. Mark G. Inghram discussed the recent work performed at Chicago on the double β decay of Te^{130} and the fission yield curves. H. C. Urey spoke on the abundances of certain isotopes in nature. He briefly summarized the results of his paleotemperature studies and Silverman's determinations of the abundance of O isotopes in rocks. Craig's table of C isotopes in nature and Thode's curve showing the abundance of S^{32} are presented.

W. Walcher reported on studies of the hyperfine structure of Ag.

1794

Palmer Physical Lab., Princeton Univ.

A NEW METHOD FOR FOCUSING ION BEAMS, by F. C. Shoemaker, R. J. Britten and B. C. Carlson. [nd] 1p. (NYO-3004)

An arrangement of small magnetic lenses has been developed for obtaining double focusing of high-energy ion beams without the expense of a magnet sufficiently powerful to produce large-angle deflections. The individual lenses have triangular plane-parallel poles and, although the deflection angle is small (~4°), have short focal lengths [$f = \rho/(2\tan\frac{1}{2}\theta)$] where θ (~90°) is the angle between the field boundaries. Under these conditions, because of the curvature of the fringing field, their focal lengths in the plane of the field are very nearly equal, but opposite in sign, to their focal lengths in the plane of the pole faces. However, if two of these astigmats are spaced a distance comparable with their focal lengths with their field directions orthogonal, a point image of a point source may be obtained. If the source distance, the separation of the astigmats, and the desired image distance are specified, the focal lengths required for double focusing can be reliably calculated from the thin-lens equation. This arrangement has been applied to the focusing of the 18.5-Mev external proton beam from the Princeton cyclotron. Two 400-lb magnetic lenses, using 400 watts each, focus 25% of the internal deflected beam on a ⅜-in spot 15 ft from the cyclotron. (Entire report)

1795

TRAJECTORIES IN AN AXIAL FOCUSING DOUBLE LENS SPECTROMETER. S. C. Snowdon. Rev. Sci. Instruments 22, 878-85(1951) Dec.

The trajectories of an electron with zero canonical angular momentum ($p_\phi - (erA_\phi/c) = 0$) have been computed with third-order accuracy for a $1/(1 + x^2)$ axial field shape. By suitably matching the above solutions with a set of similar solutions obtained by shifting the origin, it is possible to obtain the complete zero canonical angular momentum trajectories corresponding to the double lens problem in which the axial field shape approximates rather closely one that is physically realizable. The numerical computations illustrate several typical trajectories. Design considerations are given to illustrate the utility and limitations of the theory. (auth)

MATHEMATICS

1796

Los Alamos Scientific Lab.

SYMMETRICAL TYPES OF CONVEX REGIONS, by Andrew Sobczyk and P. C. Hammer. [nd] 14p. (AECU-1842; LADC-1094)

This paper gives a classification of possible types of symmetry which regions may possess, and contains several observations concerning symmetry and related matters. Many of the results do not depend on convexity, and therefore apply to all regions which are homeomorphic to the interior of a sphere.

MEASURING INSTRUMENTS AND TECHNIQUES

1797

Los Alamos Scientific Lab.

PULSE AMPLITUDE DISCRIMINATORS EMPLOYED IN NUCLEAR RESEARCH, by Herbert G. Weiss. Sept. 23, 1948. Decl. Jan. 18, 1949. 37p. (AECD-3314; LADC-579)

This paper traces the development of devices used in nuclear research for sorting pulses according to their amplitudes. The limitations and errors encountered in these devices are briefly discussed. Several early photographic methods and the later improved electronic devices are illustrated and their operation explained. A description is given of several simple discriminator circuits and their use in obtaining integral and differential bias curves. Discussion of several types of multichannel differential discriminators is included. Some heretofore unpublished information is given on a new type electrostatic deflection-tube amplitude discriminator. (auth)

1798

Argonne National Lab.

SCINTILLATION COUNTERS, by E. Avery and B. Smaller. Jan. 1952. 4p. (AECU-1848; UAC-496)

A severe limitation on the use of the scintillation counter in work requiring very small resolving times is the distribution in pulse heights at the output of the photomultiplier. To circumvent this difficulty and to provide for more stable operation, the described pulse-equalizing circuit was designed which allows pulse mixing directly for coincidence measurements and eliminates the necessity of introducing any pulse-shaping circuit. Using photomultiplier pulses having 10^{-7}-sec rise time and 2.5×10^{-7} decay time, the circuit has a resolving time of 4×10^{-8} sec.

1799

A BETATRON MONITOR AND INTEGRATOR, by Robert D. England and W. E. Ogle. [nd] 13p. (AECU-1855; LADC-774)

The development of photomultiplier-phosphor techniques for observing radioactivity suggested the possibility that such a system might provide a relatively simple method of monitoring the x-ray yield of a betatron. The development of such a monitor led in turn to the development of a circuit which would measure the integral yield of the betatron in terms of roentgen units. This paper describes the two circuits and their operation. ZnS is used in both the integrator and monitor curcuits.

1800

Material Lab., New York Naval Shipyard

INVESTIGATION OF PULSES FROM GEIGER-MUELLER TUBES OPERATED UNDER MINIMUM LOADING CONDITIONS USING OSCILLOGRAPHIC TECHNIQUES; FINAL REPORT, by W. G. Egan and A. C. Clark. June 22, 1951. 49p. (NP-3582; NE 091105)

The investigation was concerned with determining the operating characteristics of an NRL-type plateau tracer and its suitability for obtaining GM-tube plateau characteristics. The NRL plateau tracer is essentially a recording count-rate meter with a high-voltage power-supply having automatic voltage variation. The response of the count-rate meter is dependent upon both the frequency of the incoming GM pulses and their shapes. The described procedure involved determining the rise times, amplitudes, and variations in shape (including spurious pulses) of G-M pulses under minimum loading conditions for various applied voltages and count rates. The pulses from 4 different types of GM tubes were studied; all tubes utilized a halogen gas for self-quenching action. The rise times and variations in the shape of pulses from GM tubes of types BS-1 and BS-2, under minimum loading conditions, depended greatly upon the applied voltage, and to a lesser extent upon the count rate. The amplitude increased with increased voltage, except when the voltage was high enough to give continuous trains of spurious pulses. Changes in amplitude with increasing count rate were small. At the rated operating voltages, the rise time ranged from 0.7 to 6.0 μsec and the amplitude from 15 to 205 v for the various tubes. At high voltages, spurious pulses were observed with rise times slightly longer than that of the main pulse and with amplitudes from 0.1 to 0.5 that of the main pulse. With increasing voltage, the number of spurious peaks in the GM tube pulse increased and some oscillatory trains of pulses continued beyond 250 μsec after the initation of the main pulse. The data, in general, indicate that spurious pulses must be considered in deciding the characteristics necessary for an adequate plateau tracer. Recommendations are made in regard to these characteristics. (NRS abst.)

1801

Palmer Physical Lab., Princeton Univ.

A METHOD OF INCREASING THE EFFECTIVE RESOLUTION OF SCINTILLATION COUNTERS, by K. G. Standing and R. W. Peelle. [nd] 7p. (NYO-3006)

A system consisting of two photomultipliers viewing one scintillating crystal is given for resolving peaks in a scintillation spectrum which otherwise would overlap because of photomultiplier statistics. A differential discriminator accepts pulses from a fixed portion of the spectrum from one of the tubes. Another differential discriminator scans the spectrum from the second tube and is coincidence-gated by the first. Experimental results are presented which show that this method can separate monoenergetic lines not otherwise resolved. (auth)

1802

Atomic Energy Project (Canada)

PROGRESS REPORT AUGUST 16 – NOVEMBER 15, 1951; ELECTRONICS BRANCH, by J. Hardwick. [nd] 14p. (PR-P-12-E)

A brief report of the Electronics Branch is made covering the design and performance of a single-crystal spectrometer, gamma radiation probe, scintillation spectrometer, ion-exchange column monitor, pulse amplifiers, radiation-detection instruments — ion-current and pulse types, rate meters, radon breath monitors, etc.

1803

A SCINTILLATION SPECTROMETER FOR HIGH-ENERGY GAMMA-RAYS. Sven A. E. Johansson. Phil. Mag. (7) 43, 249-56(1952) Feb. (cf. NSA 5-1319)

A scintillation spectrometer is described which measures the energy of the pairs produced by γ rays. Each γ energy gives a symmetric peak in the energy distribution. The width at half-maximum is 7% at 4 Mev. The greatest advantage of this apparatus is the high sensitivity. It has been possible to measure sources with a strength of about 0.1 μc.

1804

THE IONIZATION GAUGE — TWO MODIFICATIONS. J. H. Burrow and E. W. J. Mitchell. J. Sci. Instruments 29, 27-8 (1952) Jan.

The apparent pressure indicated by an ionization gage is known to be a function of the size of the tube connecting it to the vacuum system. Gages which form part of the main pumping line joining the apparatus being exhausted and the liquid-air trap have been made. The electrodes are mounted on a ring seal rather than the usual re-entrant pinch. Ions are collected by a film of platinum burnt on the inside of the glass envelope, contact to this being made by a conical tungsten spiral spring. The ion current indicated by the modified gage is found to be two or three times greater than that of a gage of identical electrode arrangement, but mounted on a re-entrant pinch and connected to the vacuum system by a length of tube. Similarly it exhibits a greater response to transient pressures produced by the flashing of filaments and other degassing treatments in the apparatus. The remainder of the note deals with the conversion of either the modified or normal construction to contamination gages.

1805

A NEW TYPE OF α-PARTICLE BENCH MONITOR. R. D. Connor. J. Sci. Instruments 29, 12-13(1952) Jan.

The development of a Rosenblum type of spark counter as a bench monitor for α particles is described. Twenty-two such counters are arranged in parallel and the overall efficiency is found to be about 22%. The monitor exhibits a plateau of length about 250 v with a slope of 0.06%/v or better. The background counting rate is usualiy about 2 cpm. The properties of this instrument are compared with those of previously reported air counters whose mode of action differs from that of the present counter. (auth)

1806
SCINTILLATIONS IN THALLIUM-ACTIVATED CaI_2 AND CsI. W. Van Sciver and R. Hofstadter. Phys. Rev. 84, 1062-3(1951) Dec. 1.

Several samples of polycrystalline thallium-activated CaI_2 have been prepared by adding 1% of TlI to the melt of CaI_2 in a He atmosphere. It has been found that this material scintillates with a high luminous efficiency. Pulse heights of CaI_2(Tl) and NaI(Tl) were found to be about equal, while the integrated light output of CaI_2(Tl) is ~10% larger than that of NaI(Tl). The decay constant was measured as 1.1 ± 0.1 μsec. Crystals of CsI(Tl) were also examined and found to have the same decay constant as CaI_2(Tl) and an integrated light output of $\sim 0.28 \pm 0.03$ that of NaI(Tl).

1807
MULTIPLE SCATTERING OF FAST PARTICLES IN PHOTOGRAPHIC EMULSIONS. L. Voyvodic and E. Pickup. Phys. Rev. 85, 91-100(1952) Jan. 1.

The multiple scattering theory of Williams (Phys. Rev. 58, 292(1940)) is applied to photographic-emulsion techniques, and the "scattering constant" K, which is commonly used in determining particle energies from mean scattering deflections, is evaluated for various experimental conditions. For fast particles K varies from 19 to 30 for scattering cell lengths between 10 and 10^4 μ of emulsion. The scattering theories of Snyder and Scott and of Molière are also compared with that of Williams. A simple formula, based on the theory of Williams with the Molière γ factor, is derived for K for photographic emulsions, applying over a wide range of velocities and scattering thicknesses within about 1%. The results of a calibration experiment using electron pairs from Be^8 γ rays seem to confirm the validity of theoretical values of K in the region K = 22. The mean γ-ray energy for 100 electron pairs was found to be 17.4 ± 0.5 Mev. Results on the energy resolution of the scattering technique and on the distribution of scattering deflections are also found to be in reasonable agreement with theory. Finally, comparison is made between theory and other recently published emulsion-calibration experiments.

1808
THE EXPERIMENTAL DETERMINATION OF THE SPECTRUM OF A BETATRON. K. Phillips. Proc. Phys. Soc. (London) 65A, 57-9(1952) Jan.

By measuring the energy of photoprotons from deuterium, the x-ray spectrum of a betatron, of maximum energy 20 Mev, has been deduced. A small difference between the experimental determination and the theoretical curve in the 10 Mev region is found. (auth)

1809
PHOTOGRAPHIC MEASUREMENT OF U AND Th CONTENT BY THE AUTOGRAPHIC METHOD. H. v. Buttlar and F. G. Houtermans. Geochim. et Cosmochim. Acta 2, 43-61(1951). (In German)

The relation of the projected track length to the projected area in radioautography is calculated. Formulas relating the density of tracks to the content of radioelement are derived. These formulas for the statistics of track projections have been confirmed by observations on U metal, pitchblende, and monazite crystal, and the specific contents of U in the pitchblende and Th in the monazite have been determined. The U/Th ratio in homogeneous material also may be determined by this method. On two large crystals, one of monazite and one of zircon, the homogeneity of the Th and U contents has been ascertained by correlating the track density with a Poisson distribution for areas of the order of 1 mm^2. Slow variations in activity on both crystals and of the Th/U ratio on the zircon have been observed.

1810
POLISHING TECHNIQUES FOR NaI(Tl). C. A. Stone, L. Reiffel, and H. Watts. Rev. Sci. Instruments 22, 1027(1951) Dec.

NaI(Tl) crystals are rough-polished by rubbing on moistened, fine-textured cloth stretched over a metal surface and then fine-polished, in a dry box, on lens tissue charged first with tripoli powder and then with silicone grease.

1811
PROTECTIVE CONTAINERS FOR NaI(Tl). L. Reiffel, C. A. Stone, and F. G. Rest. Rev. Sci. Instruments 22, 1026-27 (1951) Dec.

In order to obtain the advantage of a clear, single crystal, to be used as a scintillation phosphor, and to retain the characteristics of permanence, several "plotting" techniques have been devised by sealing the crystal in an evacuated all-glass container. The features of the two most successful methods are described.

1812
HIGH PRESSURE BF_3 PROPORTIONAL COUNTERS. V. Cocconi Tongiorgi, S. Hayakawa, and M. Widgoff. Rev. Sci. Instruments 22, 899-904(1951) Dec.

Construction and filling procedures are described for neutron proportional counters filled to 101 cm Hg of enriched BF_3 + 20 cm Hg of A. Examples are given of the plateau and bias curves obtained for different values of the gas multiplication. Characteristics taken at different times after filling are practically identical, which indicates that no deterioration occurs. The effect of the electron affinity of the BF_3 is discussed, and it is shown how the counter parameters affect the survival probability of the electrons, hence the quality of the pulse size distribution. It has been verified experimentally that negative ions produced by electron attachment are present in the counter gas. (auth)

1813
SCINTILLATION COUNTERS FOR RADIOACTIVE SAMPLE MEASUREMENT. H. O. Anger. Rev. Sci. Instruments 22, 912-14(1951) Dec. (cf. NSA 5-3473)

A γ-ray counter for liquid or solid samples is described. It uses an RCA 5819 phototube at room temperature with a NaI(Tl) crystal in the shape of an annular ring. The γ-ray counting efficiencies of this counter for 2-ml samples of Fe^{59}, Co^{60}, and I^{131} are about equal to the β-particle counting efficiency of a mica-window G-M counter when counting thin samples. When the counter is heavily shielded, the background is about 160 cpm. The phototube operating voltage is not critical since over a wide range of operating voltage the counting efficiency and background count change only slightly. A directional γ-ray counter is also described. (auth)

1814
THE DESIGN OF FOUR-TUBE DECADE SCALERS. G. J. Fergusson and G. H. Fraser. Rev. Sci. Instruments 22, 937-40(1951) Dec.

Design factors affecting the stability and speed of four-tube sixteen-minus-six decade scalers are discussed. A design is suggested in which the stability and speed are limited only by the basic scale-of-sixteen circuit used.

1815
A CLOUD-ION CHAMBER. Martin J. Cohen. Rev. Sci. Instruments 22, 966-77(1951) Dec.

A new instrument, the cloud-ion chamber, combining the functions of an ionization chamber (utilizing free electron collection) and the Wilson cloud chamber in the same gas volume has been operated successfully for a sensitive time in excess of 1000 hours. From studies of the gas mixtures with argon as the major component, it is shown that an isoamyl alcohol and argon mixture is a satisfactory chamber filling under the operating conditions used. The operating characteristics of the cloud-ion chamber are described.

MESONS

1816

Brookhaven National Lab.

MESON THEORY, by Robert Serber. Fall, 1951. 64p. (BNL-153)

The lectures given by Dr. Serber in the Fall of 1951 at Brookhaven National Laboratory are reproduced in this report. The lectures were addressed to experimentalists; therefore most of the results are obtained by making analogy to and extension of more familiar things, rather than by rigorous mathematical methods.

1817

Brookhaven National Lab.

SCATTERING OF 50 MEV POSITIVE PIONS BY HELIUM, by A. M. Thorndike, E. C. Fowler, W. B. Fowler, and R. P. Shutt. [nd] 6p. (BNL-1073)

Positive pions of 50-Mev mean energy from the Columbia University Nevis cyclotron have been observed to undergo nuclear interactions in the gas of a diffusion cloud chamber filled with 15 atm of He and methanol vapor. A total of 3400 pictures were taken in which 345 π-μ decays in flight were observed. From this figure the total pion path length was determined to be 935 g/cm^2 of He. A total of 15 interactions were observed, giving an interaction path length of 62 g/cm^2 or a cross section of 107 millibarns. The geometrical cross section was 150 millibarns. Attempts were made to identify the interactions as absorption, elastic scattering, or inelastic scattering of the pions by He. 2 figures.

1818

Institute for Nuclear Studies, Univ. of Chicago

PRESENT STATUS OF KNOWLEDGE CONCERNING FUNDAMENTAL PARTICLES, sect.I of NUCLEAR PHYSICS AND THE PHYSICS OF FUNDAMENTAL PARTICLES; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, SEPTEMBER 17 TO 22, 1951, by Jay Orear, A. H. Rosenfeld, and R. A. Schluter, eds. [nd] 17p. (NP-3591(sect.I))

E. Fermi presented a list of 21 elementary particles and gave a few examples of how they can change from one to another. He discussed the spin and parity of the pion and the question of which reactions should be considered primary and which a second- or third-order consequence of primary reactions. Fermi defined the V particle and the τ and K mesons. L. W. Alvarez described recent experimental work at Berkeley on the following: angular distribution of γ's from π^0 decay; π^0's from p-p collisions; momentum distribution of nucleons within a nucleus; scattering of high-energy electrons; and production of mesons by photons on deuterons. E. Amaldi spoke on the scattering of μ mesons of 200 to 1000-Mev kinetic energy by nuclei. He discussed in a phenomenological way the influence of a finite electromagnetic radius of the proton on the coulomb scattering of μ mesons by light nuclei. H. L. Anderson described an experiment and gave cross-section data on the scattering of positive and negative pions from the Chicago synchrocyclotron by liquid H_2 and by D_2O. G. Bernardini discussed the following factors in the interaction of pions with nuclei: capture vs. scattering; variation of capture cross sections; capture of pions by nucleon pairs; charge-exchange scattering; and energy and angular dependence of scattered pions. He presented data obtained by exposing nuclear emulsions to the Nevis cyclotron meson beam. T. H. Johnson stated that cloud-chamber work at Columbia gives 600 g cm^{-2} of hydrogen as the mean length for scattering of 60-Mev π^- mesons. This report summarizes the speeches in fairly complete form.

1819

Institute for Nuclear Studies, Univ. of Chicago

MESON THEORY, sect.II of NUCLEAR PHYSICS AND THE PHYSICS OF FUNDAMENTAL PARTICLES; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, SEPTEMBER 17 TO 22, 1951, by Jay Orear, A. H. Rosenfeld, and R. A. Schluter, eds. [nd] 13p. (NP-3591(sect.II))

Robert Serber discussed the present status of meson theory. L. I. Schiff spoke on the nonlinear meson theory of nuclear forces, by which nuclear saturation and shell structure are accounted for in terms of many-body forces derived from mesons that obey a nonlinear wave equation. H. A. Bethe discussed meson scattering, with emphasis on the sign of neutron and proton scattering amplitudes. R. E. Marshak considered three topics in meson theory: (1) slow π^- absorption in H, D, T, and He^3; (2) scattering of mesons (scattering of π^+ mesons in D, charge-exchange scattering of π^+ in Be^9, and photoproduction of π^0); and (3) cosmic-ray stars in nuclear emulsions.

1820

Rochester Univ.

PRODUCTION OF π MESONS AT RELATIVISTIC NUCLEON ENERGIES (chap. VIII of a book on "MESON PHYSICS"), by R. E. Marshak. Dec. 5, 1951. 85p. (NYO-3038)

Chapter VIII of the book "Meson Physics" is divided into 7 sections: Section 1 contains the introduction. Section 2 contains a discussion on the predictions of the plural theory production of π mesons. Section 3 contains a discussion of several representative theories which have been proposed to describe the process of multiple-meson production in nucleon-nucleon collisions. Section 4 contains a summary of the kinematical formulas which make possible a comparison of the experimental quantities which are measured in the laboratory system and the theoretical numbers which are given in the center-of-mass system. Section 5 contains the experimental evidence in favor of the plural-meson production, while Section 6 contains the data supporting multiple-meson production. Finally, Section 7 contains a discussion of extensive air (Auger) showers as they bear on the problem of π-meson production at relativistic nucleon energies.

1821

Radiation Lab., Univ. of Calif.

PHYSICS DIVISION QUARTERLY REPORT; AUGUST, SEPTEMBER AND OCTOBER. Dec. 12, 1951. 34p. (UCRL-1610)

The method developed for investigating the positron spectrum from the decay of the μ meson is described. The mathematical methods are developed to aid in eliminating errors in measuring the positron energy. Photographs are given showing high-energy electron-electron scattering. A microphotograph of the decay of a π meson is shown in the range of the μ meson. A new technique is described for measuring nuclear scattering cross sections of π-mesons as they traverse a semi-infinite scatterer. The energy distribution of protons scattered from D and from C at angles of 30 and 40° have been obtained by means of the 35-channel magnetic particle spectrometer. A study of the pick-up process in proton-deuteron scattering is described. The operation and development of the UCRL particle accelerators are given.

1822

PROPERTIES OF THE PION. J. de Boer. Nederland. Tijdschr. Natuurk. 17, 341-8(1951) Dec. (In Dutch)

A brief review of the available information on the spins, masses, and fields of the charged and neutral π mesons is presented. 11 references.

1823

THE INTERACTION OF π-MESONS WITH CARBON NUCLEI. Anatole M. Shapiro. Phys. Rev. 84, 1063(1951) Dec. 1.

Beams of π mesons have been focused by a double magnet into a cloud chamber containing nine thin C plates. The pic-

tures were analyzed stereoscopically and the events, classified as elastic scatterings, nuclear interactions, or traversals, are tabulated. Corrected mean free paths and corresponding cross sections for nuclear interactions and elastic scatterings are also given. The C nucleus was found to be considerably transparent to the mesons (average energy 48 Mev), and the cross sections for π^- and π^+ are approximately equal. The total scattering cross section of a meson by a nucleon as calculated by the transparent-nucleus theory is compared with Anderson's experimental value (Chicago International Conference, Sept. 17-22, 1951), and it is concluded that the amplitudes for scattering of a meson by a proton and by a neutron have opposite signs and that the coupling is probably pseudovector.

1824

IONIZATION IN OXYGEN BY μ-MESONS. S. K. Ghosh, G. M. D. B. Jones, and J. G. Wilson. Proc Phys. Soc. (London) 65A, 68-9(1952) Jan.

Preliminary results are reported of measurements of the ionization by μ mesons in oxygen as a function of meson momentum. These results show the expected logarithmic increase of ionization in the relativistic domain. The present data are based on drop counts in a cloud chamber along the trajectory of μ mesons, the momenta of which are determined in the Manchester magnetic spectrograph.

1825

ON THE TOMONAGA METHOD FOR INTERMEDIATE COUPLING IN MESON FIELD THEORY. R. H. Dalitz and D. G. Ravenhall. Phil. Mag. (7) 42, 1378-83(1951) Dec.

An iteration method is employed to improve the approximate wave function used by Tomonaga (Progress Theoret. Phys. (Japan) 2, 6(1947)) to describe the scalar meson field of an isolated nucleon. It is found that this wave function of Tomonaga is surprisingly good, even in the region of intermediate coupling, the change in coupling parameter for given energy being at most 3% after the first iteration. (auth)

1826

THE INTERACTION OF FAST π-MESONS WITH NUCLEI. W. O. Lock and G. Yekutieli. Phil. Mag. (7) 43, 231-48 (1952) Feb.

A study has been made of the nuclear disintegrations produced by π mesons of energy between 50 and 1100 Mev, and they have been compared with those produced by protons of energy up to 800 Mev. The results are consistent with the hypothesis that a π meson commonly interacts with a complex nucleus by making two or more elastic collisions with its nucleons. By studying the characteristics of the meson 'stars', estimates have been obtained of the relative probabilities of the meson being absorbed in a nuclear collision, of undergoing charge exchange, or of being elastically scattered. (auth)

1827

OBSERVATION OF A HEAVY MESON OF TYPE κ IN A NUCLEAR PHOTOGRAPHIC PLATE. Jean Crussard, Claude Mabboux, Daniel Morellet, Jacques Trembley, and Agnés Orkin-Lecourtois. Compt. rend. 234, 84-6(1952) Jan. 2. (In French)

On an Ilford G5 plate exposed by balloon at 35,000 m a particle of unit charge and 1300-μ path was observed to stop in the emulsion, giving birth to a high-energy particle at almost a right angle. Range of the emitted particle was 20,000 μ. The incident particle is considered to be the same as that observed and labeled κ_1 by O'Ceallaigh (Phil. Mag. 42, 1032(1951)). Its mass was 1200 (+1900, −740) m_e. The secondary particle could not be definitely identified, but its mass was $\leq$400 m_e, possibly a π or μ meson.

MOLECULAR PROPERTIES

1828

THEORY OF MOLECULAR HYDROGEN AND DEUTERIUM IN MAGNETIC FIELDS. Norman F. Ramsey. Phys. Rev. 85, 60-5(1952) Jan. 1.

The hamiltonian of a diatomic homonuclear molecule in a magnetic field is discussed. Included in the hamiltonian are the effects of the nuclear and rotational magnetic moments interacting with the external magnetic field, magnetic shielding, molecular diamagnetism, the spin-spin magnetic interaction of the two nuclei, the interaction of the nuclear magnetic moments with the field due to the rotation of the molecule, and the interaction of nuclear electric quadrupole moments. Perturbation theory expressions for the energy of H_2 and D_2 in the first rotational state are obtained in both strong and weak field limits. The secular equation is numerically solved for intermediate fields. Curves are given showing the theoretical dependence of the energy and the transition frequencies upon the field. (auth)

NEUTRONS

1829

Argonne National Lab.

PHOTO-NEUTRON SOURCES, by A. Wattenberg. Jan. 1948. Decl. Feb. 27, 1948. 18p. (AECD-3302; ANL-HDY-426)

Methods of producing monoenergetic neutrons are reviewed. The reactions of γ rays in Be^9 and D are discussed as to energetics. Gamma emitters are listed with half lives, γ energies, nuclear reactions by which they can be produced, and cross sections for the (n,γ) reaction. Theoretical and observed estimates of the energies of photoneutrons from various sources containing γ emitters plus Be or D are tabulated, and experimental techniques for determining the energy of the emitted neutrons are briefly indicated. The yields of neutrons from standard sources are given. Advantages and disadvantages in the use of sources of different shapes are discussed. No new data are given.

1830

Los Alamos Scientific Lab.

THEORY OF FLUCTUATION SCATTERING OF SLOW NEUTRONS IN SOLIDS, by Louis Goldstein and Henry S. Sommers. [nd] 24p. (AECU-1852; LADC-1092)

A theory of coherent scattering processes of slow neutrons arising from density fluctuations in solids is proposed. Such a process is a generalization of the same phenomenon present in liquids. Formally, the theory is similar to the one developed by Brillouin for the scattering of x rays and ultraviolet or visible radiation in isotropic transparent solids. The slow-neutron fluctuation cross sections are quite small in most metals and rigid solids. In graphite, however, careful experimental work could help to establish whether the process studied here is present to the extent predicted by the theory or not. (auth)

1831

Atomic Energy Project (Canada)

RESEARCH IN NEUTRON PHYSICS AT CHALK RIVER, by B. W. Sargent. Mar. 27, 1947. Decl. Mar. 1948. 12p. (PD-223)

A detailed report is given on the diffusion, diffusion lengths, and the transport mean free path of thermal neutrons in heavy water and on the effect of delayed neutrons on reactor shutdown.

1832

ELECTRON-NEUTRON INTERACTION. G. Breit. Proc. Natl. Acad. Sci. U. S. 37, 837-46(1951) Dec.

The explanation of the electron-neutron interaction advanced by Foldy is analyzed without the employment of the special canonical transformation of Foldy and Wouthuysen. The meaning of the Pauli magnetic moment term is illustrated by a consideration of special cases and of the equations of motion which show how the term corresponds to the visualization of a classical magnetic doublet oriented along the spin of the neutron. The interaction of the neutron moment with the divergence of the electric field is compared with a similar effect in a phenomenologic treatment of the electron's magnetic moment which has previously been calculated. The more closely relativistic treatment of the latter calculation enables one to express the answer in terms of Dirac functions rather than their Schroedinger approximations. Assumptions sufficient for the applicability of Foldy's explanation independently of details of the origin of the neutron's magnetic moment are discussed. (auth)

NUCLEAR PHYSICS

1833

Institute for Nuclear Studies, Univ. of Chicago
NUCLEAR PHYSICS AND THE PHYSICS OF FUNDAMENTAL PARTICLES; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, SEPTEMBER 17 TO 22, 1951, by Jay Orear, A. H. Rosenfeld, and R. A. Schluter, eds. [nd] 211p. (NP-3591)

Fairly complete summaries are given of the talks made at the conference. Separate abstracts have been prepared for the following sections of this report: Present Status of Knowledge Concerning Fundamental Particles, sect.I; High Energy Accelerator Design, sect.IA; Reactions of Light Nuclei, sect.IB; Meson Theory, sect.II; Mass Spectroscopy, sect.IIA; Scattering of Nuclear Particles, and Nuclear Forces, sect.IIB; On the Inversion Properties of Spin ½ Fields (Special Session), sect.IIC; Nuclear Abundances and Cosmogony, sect.III; Nuclear Structure and Isomerism, sect.IV; Beta-Ray Spectra and Neutrinos, sect.IVA; Neutrons and Fission, sect.IVB; and Gamma Rays and Photonuclear Reactions, sect.V.

1834

Radiation Lab., Univ. of Calif.
SUMMARY OF RESEARCH PROGRESS MEETING OF SEPTEMBER 27, 1951, by Sergey Shewchuck. Nov. 14, 1951. 7p. (UCRL-1563)

Ernest O. Lawrence briefly described the operation and design of his color television tube. R. Jastrow briefly reviewed the reports presented at the International Conference on Nuclear Physics at Chicago.

1835

Radiation Lab., Univ. of Calif.
THE TRANSURANIUM ELEMENTS; EARLY HISTORY, by Edwin M. McMillan. Dec. 12, 1951. 16p. (UCRL-1619)

A lecture is given on the circumstances that led to the discovery and identification of Np and a discussion of the methods used in the separation of the element.

1836

THE DEEPEST STATES OF THE GROUND CONFIGURATION OF gg NUCLEI. P. Stähelin and P. Preiswerk. Helv. Phys. Acta 24, 623-5(1951) Dec. 31. (In German)

A graph of a function of the energy of the first excited state of gg nuclei, i.e., those having even proton and even neutron numbers, is presented which illustrates clearly the effect of "magic numbers." Relation of the function to spin, parity, and doubly magic nuclei is discussed.

1837

THE UPPER LIMIT FOR THE NEUTRINO REST MASS. O. Kofoed-Hansen. Phil. Mag. (7) 42, 1448-50(1951) Dec.

The β spectrum of H^3 is discussed as the best possibility for determination of the rest mass of the neutrino. The shape of the β spectrum for a finite neutrino mass is expressed as an equation, and three hypothetical Kurie plots derived from numerical evaluation of the equation are shown. The experimental results of Hanna and Pontecorvo (Phys. Rev. 75, 983(1949)) are interpreted in the light of this Kurie plot, with the conclusion that the neutrino mass is <5 kev, or smaller than 1/100 of the electron mass.

NUCLEAR PROPERTIES

1838

Argonne National Lab.
ELECTROMAGNETIC EFFECTS DUE TO SPIN-ORBIT COUPLING, by J. Hans D. Jensen and M. Goeppert Mayer. Univ. of Wisconsin and Argonne National Lab. Jan. 1952. 2p. (AECU-1851; UAC-492)

The electromagnetic effect due to spin-orbit coupling is discussed. The existence of strong spin-orbit coupling in the single-particle model of the nucleus implies the existence of a term

$$-f(r)\,(\vec{\sigma},\vec{L}) = -f(r)\,(\vec{\sigma}\cdot[\vec{r}\times\vec{P}])$$

in the single-particle hamiltonian. This gives rise to an interaction of charged nucleons with external electromagnetic fields with vector potentials A. A consequence of this effect is that the magnetic moments of odd-proton nuclei should deviate from the Schmidt lines as is observed experimentally. Another consequence discussed is the additional radiative transition probabilities which are important in the cases where the ordinary transitions have vanishing matrix elements. As suspected the electric transitions are not affected, which is in agreement with a general theorem given by Sacks and Austin (Phys. Rev. 81, 705(1951)).

1839

Institute for Nuclear Studies, Univ. of Chicago
NUCLEAR STRUCTURE AND ISOMERISM, sect.IV of NUCLEAR PHYSICS AND THE PHYSICS OF FUNDAMENTAL PARTICLES; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, SEPTEMBER 17 TO 22, 1951, by Jay Orear, A. H. Rosenfeld, and R. A. Schluter, eds. [nd] 19p. (NP-3591(sect.IV))

J. H. D. Jensen spoke at some length on nuclear structure and isomerism. B. T. Feld discussed the hfs anomaly which arises because ratios of nuclear magnetic moments for two isotopes are not the same when obtained from the hyperfine splitting of electronic levels as when they are obtained directly from a nuclear resonance technique. M. Goldhaber reported on the classification of nuclear isomers. Much of his talk followed the summary by the same title by Goldhaber and Sunyar in Phys. Rev. 83, 906(1951), but some new results are given on the following: effect of electron configuration on the isomeric half life; M4 and E5 transitions; energy systematics of $S\,½$, $D\,⅗$, and $H\,11/2$, states energy systematics of $P\,½,7/2+$, and $G\,⅘$ levels; first excited state of even-even nuclei; and M1 and E2 transitions. K. Siegbahn summarized Kr and Xe activities from fission. Maria G. Mayer discussed the theory of isomerism; she compared the theoretical half life for M4 transitions with the Weisskopf predictions and the E3 transition probabilities with the Weisskopf estimates. R. E. Bell listed the half lives of Hg^{199}, Xe^{131}, and Hg^{198} as the shortest measurable with present techniques, and Z. Bay presented a method for narrowing the delay pulse for measurement of half lives of $\sim 10^{-10}$ sec. S. De Benedetti spoke on the isomeric state of Pb^{206} and the annihilation half life of the positron in various absorbers. D. R. Inglis proposed a model for light nuclei,

and E. Wigner remarked on the validity of jj-coupling for light nuclei.

1840
New York Univ.
ON THE ACTIVATION ENERGY OF NUCLEAR FISSION, by R. D. Present, F. Reines, and J. K. Knipp. New York Univ. and Purdue Univ. [nd] 26p. (NP-3620)

1841
Radiation Lab., Univ. of Calif.
NUCLEAR MOMENTUM DISTRIBUTIONS IN DEUTERIUM AND CARBON INFERRED FROM PROTON SCATTERING (thesis), by John Baros Cladis. Jan. 2, 1952. 65p. (UCRL-1621)

This report concerns the energy spectra of protons scattered from H, D, and C at angles of 30 and 40°. These angles were chosen so that the nuclear diffraction scattering would be negligible in comparison to the scattering due to quasi-elastic collisions. Wolff's theoretical spectra are used to infer nucleon momentum distributions of D and C. The forms of the curves certainly reveal the prevalence of quasi-elastic scattering. The peaks of the spectra from D and C fall at slightly lower energies than those of the corresponding spectra from H, the differences being qualitatively explained by nuclear well and excitation effects. (auth)

1842
ANGULAR DISTRIBUTION OF γ-RADIATION FROM POLARIZED NUCLEI. N. R. Steenberg. Phys. Rev. 84, 1051-2 (1951) Dec. 1.

The dependence of intensity of γ emission from polarized nuclei on the angle between the direction of emission and the axis of polarization is calculated. Spiers (National Research Council of Canada publication #1925) has given the dependence for a single emission for arbitrary degree of polarization, and considerably simpler formulas valid for low degrees of polarization. These latter are extended by the present author to apply to a cascade of γ rays from an oriented γ-emitting nucleus and to a cascade of γ rays following a β emission from an oriented γ-emitting nucleus.

1843
BETA-GAMMA ANGULAR CORRELATION IN THE DECAY OF I^{126} AND K^{42}. Donald T. Stevenson and Martin Deutsch. Phys. Rev. 84, 1071(1951) Dec. 1.

The β-γ angular correlation in the decay of I^{126} and of K^{42} has been measured by techniques described previously (Phys. Rev. 83, 1202(1951)). The observed anisotropy of the β-γ coincidence rate, E(180°), as a function of β-ray energy for I^{126} is plotted. E is the excess of the coincidence rate at 180° over that at 90°. For K^{42} the anisotropy found for 1.23-Mev β rays was $E = -0.055 \pm 0.024$, and for 1.55-Mev β rays, $E = -0.065 \pm 0.023$. The interpretation of these results in the form of J values and matrix elements is briefly discussed, and the similarity between the I^{126} and K^{42} decay schemes and that of Rb^{86} is noted.

1844
INTERNAL CONVERSION ANGULAR CORRELATIONS. M. E. Rose, L. C. Biedenharn, and G. B. Arfken. Phys. Rev. 85, 5-16(1952) Jan. 1.

It is shown that the angular correlation between a conversion electron and any other radiation emitted in a double nuclear cascade can be obtained immediately if the corresponding correlation with a γ ray replacing the conversion electron is known. This latter is known for all cases of practical interest. Specifically, if the correlation function for γ rays and a radiation x is expanded in Legendre polynomials, the correlation function with a conversion electron replacing the γ ray is obtained by multiplying the coefficients of each polynomial P_ν by a parameter b_ν. The case of conversion-conversion correlation, in all practical cases, is obtained from the γ-γ correlation by inserting two factors b_ν, one for each conversion electron. The coefficients b_ν are calculated relativistically and numerical results are presented for K-shell conversion for 12 values of Z in the range $10 \leq Z \leq 96$ and transition energies from 0.3 mc^2 to 5.0 mc^2 for ten multipoles (5 electric and 5 magnetic). It is pointed out that the present results apply in γ-electron correlation if the γ is a mixed multipole, but the case in which the conversion transition is mixed is not computed. The angular distribution functions for electrons in a coulomb field undergoing any type of transition are obtained in terms of the relevant matrix elements by the use of the Green function for the Dirac electron in a coulomb field. It is also shown that the angular distribution function is obtained from matrix elements based not on the scattered wave but on the time-space reversed scattered wave. (auth)

1845
NUCLEAR MAGNETIC MOMENT AND j−j COUPLING SHELL MODEL. Masataka Mizushima and Minoru Umezawa. Phys. Rev. 85, 37-40(1952) Jan. 1.

It is shown that the magnetic moment of nuclei can be explained by a refined j−j coupling shell model, where neutron and proton shells are treated simultaneously, using the isotopic spin variable. The experimental moments agree well with the calculated ones for those states which have definite isotopic spin multiplicity. It is shown that a nuclear force caused by a neutral or symmetric meson is consistent with the results, but one caused by a charged meson is excluded. (auth)

1846
POLARIZATION AND ALIGNMENT OF NUCLEI. A. Simon, M. E. Rose, and J. M. Jauch. Phys. Rev. 84, 1155-9(1951) Dec. 15.

Four methods for nuclear polarization and alignment are discussed and compared. In particular, a general theorem regarding the leading term in the expression for nuclear polarization by hfs coupling with external field is obtained. A general method is derived for treating the computation of higher order terms in the expansions of these quantities, as well as for use with complicated hamiltonians, and application is made to three cases of interest. It is shown that the higher order terms are very small, in cases of interest, compared to the leading terms. (auth)

1847
PARAMAGNETIC RESONANCE AND HYPERFINE STRUCTURE IN THE IRON TRANSITION GROUP. A. Abragam. Physica 17, 209-12(1951) Mar.-Apr. (In English)

Theoretical calculations on the hfs of paramagnetic resonance lines show very strong disagreement with experiment for Cu Tutton salts, Cu fluosilicate, Mn Tutton salts, and Mn fluosilicate. All these calculations are based on the assumption that the wave function of the ion is correctly represented by a single configuration. The suggested influence of excited configurations, with 3d electrons promoted to the 4s shell, turns out to have the wrong sign (Cu) or to be negligible (Mn). These discrepancies can be consistently explained in all these salts by assuming promotion of a 3s electron to a 4s shell. An earlier attempt in which a covalent bonding was assumed between the ion and the surrounding water molecules explained the hfs but led to wrong values for the g's. (auth)

1848
ON THE NUCLEAR LEVEL DIAGRAM OF THORIUM C′. Salomon Rosenblum. Compt. rend. 234, 202-4(1952) Jan. 7. (In French)

The energies of the excitation levels of ThC′ (Po^{212}) are given by the formula $E_n = \kappa\,[2 + (1/n-2)] + \epsilon$, the correction term ϵ being taken as 13 kev and κ as 715 kev

($\approx E_{\alpha_0}/4\pi$). Energies calculated for n from 1 to 11 are compared with experimental values and related to the structure of the ThC′ nucleus.

1849

NUCLEAR MAGNETIC MOMENT OF SCANDIUM OF MASS 45. D. M. Hunten. Can. J. Phys. 29, 463-9(1951) Nov. (cf. NSA 4-4670)

By the method of nuclear magnetic resonance, the magnetic moment of Sc^{45} (without diamagnetic correction) is found to be 4.74916 ± 0.00012. The correction is + 0.00717 with unknown and possibly large error. The equipment designed to search for magnetic resonance by varying the field of the magnet is described, with special emphasis on the magnet current regulator. (auth)

1850

THE NUCLEAR MAGNETIC MOMENTS OF ARSENIC AND TITANIUM. C. D. Jeffries, H. Löliger, and H. H. Staub. Helv. Phys. Acta 24, 643-4(1951) Dec. 31.

The nuclear magnetic moment of As^{75} has been measured in alkaline solutions of AsO_4^{-3} and AsS_4^{-3}, by a nuclear-induction spectrometer, to be $\mu = +1.4350 \pm 0.0003$ nuclear magnetons, without diamagnetic correction. The gyromagnetic ratio 1507 has been found for both the odd nuclei Ti^{47} and Ti^{49} in $TiCl_4$, $TiBr_4$, and H_2TiF_6. Taking the spin I as 7/2 leads to $\mu = -1.101$.

1851

NEUTRONS FROM THE SPONTANEOUS FISSION OF THORIUM. F. R. Barclay, W. Galbraith, and W. J. Whitehouse. Proc. Phys. Soc (London) 65A, 73(1952) Jan.

The purpose of this letter is to resolve a point regarding the number of neutrons emitted in the spontaneous fission of Th. The early work of Pose (1943) appears to give a value for ν, the average number of neutrons emitted per fission, of between 5 and 6. This is considerably greater than that obtained, for example, in the slow neutron induced fission of U^{235} for which ν is 2.5 ± 0.1 (Atomics, 1951). The counting rates obtained with U and Th show that the ratio of neutron emissions from U and Th is 153 ± 10, and since the ratio of the spontaneous fission rates of U and Th is 164 ± 13 (Segrè, 1951) the value of ν for Th is within the statistics, the same as that for U, i.e., $\nu_{Th}/\nu_U = 1.07 \pm 0.10$. This confirms the statement that Pose's ν for Th is too high.

NUCLEAR REACTORS

1852

Los Alamos Scientific Lab.

THE LOS ALAMOS HOMOGENEOUS REACTOR, SUPO MODEL, by L. D. P. King. Issued Feb. 7, 1952. 17p. (LA-1301)

Extensive modifications on the Los Alamos Hypo model "water boiler" have resulted in a new model, Supo. The operating power level has been raised from 5.5 to 30 kw, the reactor solution has been changed from 15% U^{235}-enriched $UO_2(NO_3)_2$ to 88.7% enrichment, and extensive improvements have been made in experimental facilities. The new reactor is described and illustrated. 11 figures.

1853

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.

PRODUCTION OF RADIONUCLIDES, by John W. Irvine, Jr. 33p. [nd] (NP-3619)

1854

Atomic Energy Project (Canada)

THE LOW POWER PILE AT CHALK RIVER, by B. W. Sargent. March 25, 1947. Decl. March 1948. 10p. (PD-224)

1855

THE NORWEGIAN-DUTCH NUCLEAR REACTOR. J. de Boer. Nederland. Tijdschr. Natuurk. 17, 348-51(1951) Dec. (In Dutch)

The heavy-water reactor, "Jeep," built at Kjeller, Norway, is described briefly, and photographs of the pile face, the Al D_2O tank, a model of the entire reactor, and the D_2O tank in position behind the concrete shield are presented.

NUCLEAR TRANSFORMATION

1856

Oak Ridge National Lab.

Mo^{99}, Ag^{111} AND Ba^{140} YIELDS FROM PROTON-INDUCED FISSION (abstract), by W. H. Jones, J. L. Fowler, and J. H. Paehler. [nd] Decl. Jan. 15, 1952. 1p. (AECD-3306)

Stacks of foils of normal U and Al were bombarded at a fixed radius in the 86-in. proton cyclotron. By use of radiochemical techniques, the fission yields of Mo^{99} and Ag^{111} relative to Ba^{140} were determined as a function of proton energy in the region 11 to 18 Mev. These three isotopes occur at the peaks and valley of the thermal-neutron-fission mass distribution. Relative yields were obtained in terms of known yields by performing the identical radiochemical analysis for thermal-neutron fission in similar quantities of normal U. The energy of the internal cyclotron beam was found from the proton range in Cu and the known (p,n) and (p,2n) excitation curves of Cu^{63}. The ratio, $\text{Yield}_{Mo^{99}}/\text{Yield}_{Ba^{140}}$, is almost constant as a function of proton energy and is about 60% higher than in the case of thermal-neutron fission. The ratio, $\text{Yield}_{Ag^{111}}/\text{Yield}_{Ba^{140}}$, which is taken as 0.0029 for thermal-neutron fission, (Revs. Modern Phys. 18, 513(1946)) varies with proton energy as follows: 0.26 ± 0.02, 0.36 ± 0.02, and 0.48 ± 0.03 at $E_p = 11.6 \pm 1.0$, 14.6 ± 1.0, and 17.6 ± 1.0 Mev, respectively.

1857

Atomic Energy Project (Canada)

THERMAL NEUTRON FISSION YIELDS OF U^{233} AND U^{235}, by W. E. Grummitt and G. Wilkinson. Mar. 1951. 13p. (CRC-470)

A quantitative survey has been made of the longer-lived fission-product activities produced by bombardment of U^{233} and natural U with thermal neutrons in a reactor. The experimental procedure and counting of samples are described; the yields of isotopes are tabulated and their dependence on mass number is discussed. The following three previously unreported isotopes were recognized: 136 ± 2-day Sn^{123}; 2.7-yr Sb^{125}; and ~15-day Cs^{136}. The 17-day Sn activity reported earlier (Nature 158, 163(1946); 161, 520(1948)) was not confirmed in further experiments.

1858

Ames Lab.

AN ANALYSIS OF SOME PHOTO-NEUTRON AND PHOTO-PROTON EXPERIMENTS, by Arthur Paskin. Jan. 31, 1952. 17p. (ISC-202)

The statistical theory of nuclear reactions is applied to some photonuclear experiments. The data of Hirzel and Wäffler (Helv. Phys. Acta 20, 373(1947); 21, 200(1948)) on the relative number of protons and neutrons from photo-reactions on the middle-weight elements are found to be in agreement with statistical theory if the proper thresholds are used. The photo-experiments of Halpern and Mann (Phys. Rev. 83, 370(1951)), and Katz and Cameron (Phys. Rev. 84, 1115(1951)) on aluminum are also found to be in agreement with theory below 20 Mev. The agreement at higher energies is improved if, besides using proper thresholds, multiple-particle emission is take into consideration. There is some evidence above 20 Mev that either there are direct interactions between nucleons and photons with the prompt ejection of the nucleon or gamma emission offers more competition with nucleon emission than has been theoretically assumed. (auth)

1859
Institute for Nuclear Studies, Univ. of Chicago
REACTIONS OF LIGHT NUCLEI, sect.IB of NUCLEAR PHYSICS AND THE PHYSICS OF FUNDAMENTAL PARTICLES; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, SEPTEMBER 17 TO 22, 1951, by Jay Orear, A. H. Rosenfeld, and R. A. Schluter, eds. [nd] 26p. (NP-3591(sect.IB))

R. F. Taschek spoke on the status of work on the lightest nuclei. Cross-section curves for the following are presented and/or discussed: $H^2(t,n)H^4$; $H^3(t,2n)He^4$; $H^3(p,n)He^3$; $H^3(p,\gamma)He^4$; $He^3(d,p)He^4$; $H^3(d,n)He^4$; $H^2(d,p)H^3$; $H^2(d,n)He^3$; $Li^7(t,\gamma)Be^{10}$; and for p-He, d-t, d-He^3, D-He^4, d-d, d-p, and p-d scattering. T. W. Bonner described the Rice Institute investigation of the $H^3(p,n)He^3$ reaction. The Harwell experiment on $Be^7(n,p)$ was briefly summarized by E. Bretscher; a group of particles with 1.44-Mev energy were found, and the reaction cross section was determined to be 10^4 barns. J. Rotblat reported on the photographic-emulsion program of the Universities of Liverpool, Bristol, and London. Results are presented on the angular distribution of particles emitted in the disintegration of light nuclei under deuteron bombardment. The spin and parity of the excitation levels of C^{13} are given, as determined by the reaction $C^{12}(d,p)$, and spins and parities of the states of N^{13}, N^{15}, A^{41}, O^{17}, and F^{17} are tabulated. The angular distribution of α particles from $N^{14}(d,\alpha)C^{12}$ and of deuterons elastically scattered on N are also shown. J. M. Cassels discussed deuteron reactions in light nuclei. Spin and parity assignments for F^{17}, N^{13}, and Ne^{21} are tabulated, and the angular distribution of tritons from the $Be^9(d,t)Be^8$ ground-state transition is plotted. The theory of reactions of the type X(d,p/n)Y using a model of deuteron stripping was evaluated by R. E. Peierls. A. H. Snell reported preliminary results obtained with the ORNL 6-Mev electrostatic generator. Neutron yields for brass, Mo, Ta, W, Li, and Be^9 are plotted as a function of bombarding proton energy. The graph of γ rays emitted by F under proton bombardment reveals 15 new resonances under 5.2 Mev. W. Whaling discussed the 3.58-Mev level in Li^6. P. Huber spoke on the scattering of fast (2 to 4 Mev) neutrons from O^{16}. The energy levels of O^{17} are given. O. R. Frisch briefly reported on his experimental results on the spins and parities of the energy states in O^{16}.

1860
Institute for Nuclear Studies, Univ. of Chicago
NEUTRONS AND FISSION, sect.IVB of NUCLEAR PHYSICS AND THE PHYSICS OF FUNDAMENTAL PARTICLES; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, SEPTEMBER 17 TO 22, 1951, by Jay Orear, A. H. Rosenfeld, and R. A. Schluter, eds. [nd] 11p. (NP-3591 (sect.IVB))

D. J. Hughes described recent experiments with pile neutrons. Several cross-section curves are shown. L. B. Borst's talk on new long-period (3, 12, and 125 min) delayed neutrons produced in U fission is summarized in this section and reproduced in detail in an appendix. M. Paul discussed a magnetic lens for focusing neutral particles. Results given by H. Barschall on fast-neutron cross-section measurements are presented in the form of graphs. Experiments on the fission of Bi by betatron irradiation were reported by N. Sugarman. E. Bretscher described experiments designed to measure μ-meson-induced fission in U and concluded that μ^--induced fission does not occur with appreciable probability.

1861
Institute for Nuclear Studies, Univ. of Chicago
GAMMA RAYS AND PHOTONUCLEAR REACTIONS, sect.V of NUCLEAR PHYSICS AND THE PHYSICS OF FUNDAMENTAL PARTICLES; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, SEPTEMBER 17 TO 22, 1951, by Jay Orear, A. H. Rosenfeld, and R. A. Schluter, eds. [nd] 27p. (NP-3591(sect.V))

The talk by J. W. M. Du Mond describing the new γ spectrometer at Calif. Inst. of Tech. is presented in abridged form. Data are given on the γ rays following decay of Ir^{192}. E. Baldinger described measurements of the γ-ray pair-production cross section as a function of atomic number. Martin Deutsch discussed the short-range interaction of electrons and the fine structure of positronium. The energy distribution of photoprotons from $A^{40}(\gamma,p)Cl^{39}$ is plotted, as presented in the talk by D. H. Wilkinson. H. Waffler described an investigation of the photodisintegration of the deuteron by the Li γ ray. H. von Halban spoke on the photodisintegration of deuterium. R. N. H. Haslam discussed photoactivation of the nucleus. Activation and/or cross-section curves are shown for $Cu^{65}(\gamma,\alpha)$; $N^{14}(\gamma,n)$; $O^{16}(\gamma,n)O^{15}$; and for (γ,α), $(\gamma,\alpha n)$, and $(\gamma,\alpha p)$ reactions in nuclear emulsions. D. W. Kerst reported briefly on measurements of total photoneutron yields; angular dependence curves of Bi and Ni are shown. S. Kikuchi discussed photoproduction of stars above the meson threshold. V. L. Telegdi spoke on α-α correlations in the photodisintegration of C^{12} and the resonant absorption of electromagnetic radiation of non-electric-dipole character.

1862
Radiation Lab., Univ. of Calif.
NUCLEAR REACTIONS OF IRON WITH 340 MEV PROTONS, by G. Rudstam, P. C. Stevenson, and R. L. Folger. Dec. 7, 1951. 36p. (UCRL-1586)

Natural Fe has been bombarded with the full-energy proton beam of the Berkeley 184-in. synchrocyclotron, and a number of radioactive spallation products have been isolated and identified and their formation cross sections measured against that of the reaction $Al^{27}(p,3pn)Na^{24}$. A simple mechanism is postulated to account for the observed product yields. A new isotope of Cr, assigned to mass 48, was observed and partially characterized. (auth)

1863
Radiation Lab., Univ. of Calif.
DEUTERON PHOTODISINTEGRATION AT HIGH ENERGIES (thesis), by William Gilbert. Dec. 7, 1951. 70p. (UCRL-1590)

The reaction $\gamma + d \rightarrow p + n$ was investigated using the bremsstrahlung spectrum from the Berkeley electron synchrotron, which has a quantum limit of ~320 Mev. The target consisted of D_2 gas (2000 psi, 77°K). Protons were detected by a scintillation-counter telescope system. The circuit was such that the detection system was specific in its acceptance of proton events and rejection of meson events. The energy of a proton accepted by the system could be determined by the use of absorbers in front of the counter telescope, and the angular and energy resolution of the system was sufficient to define the energy of the initial γ ray to a few Mev. $(d\sigma/d\Omega)_\theta$ was determined at angles of 30, 45, 60, 75, and 90°(lab.) for E_γ (c.m.) = 200 ± 15 Mev, and at angles of 30, 45, 60, 75, 90, 105, and 115°(lab.) for E_γ (c.m.) = 250 ± 15 Mev. Total cross sections obtained were: σ_t (200 Mev) = 10.0 ± 3.0 × 10^{-29} cm^2; σ_t (250 Mev) = 15.9 ± 6.4 × 10^{-29} cm^2. These data indicate that, above the threshold for production of mesons, the cross section for the photoeffect rises with increasing photon energy and that around 140 Mev the cross section is larger than would be predicted by theories which exclude the effects of meson interaction.

1864
Radiation Lab., Univ. of Calif.
HIGH ENERGY SPALLATION PRODUCTS OF ZINC (thesis),

by William Jacob Worthington, Jr. Jan. 8, 1952. 58p. (UCRL-1627)

Elemental Zn was bombarded with 340-Mev protons. A study was made of the various radioactive spallation product fractions resulting from such a bombardment. In the course of the work 34 radioactive nuclides from Ga through Na were identified by separating the various elemental fractions chemically and characterizing the half lives, type, and energy of particulate radiation, and energy of x rays of the isotopes. The formation cross sections were calculated for the isotopes identified. The general distribution of the spallation products in regard to quantity produced and position in the periodic chart was found to be in general agreement with results previously reported for spallation products of other elements. One previously unidentified isotope was discovered. This isotope was identified as Ni^{56}. (auth)

1865

Radiation Lab., Univ. of Calif.

NEUTRAL MESON GAMMA SPECTRA FROM PROTON BOMBARDMENT OF CARBON (thesis), by Walter Ellis Crandall. Jan. 8, 1952. 53p. (UCRL-1637)

Carbon targets were bombarded by protons of energy 185 to 345 Mev in the Berkeley cyclotron. The γ rays from π° meson decay were converted into electron-positron pairs by a Ta radiator, and the pairs were detected by an array of G-M tubes backed by pairs of proportional counters in quadruple coincidence. The excitation function for production of π° mesons by proton bombardment of C is shown. An upper limit of $<10^{-12}$ sec was set for the π° half life. A polar plot of the pion energy distribution indicates that the neutral pions are emitted with a $\cos^2 \theta$ dependence.

1866

Radiation Lab., Univ. of Calif.

THE PHOTO-DISSOCIATION OF THE DEUTERON BY HIGH ENERGY GAMMA-RAYS, by Seishi Kikuchi. Jan. 24, 1952. 7p. (UCRL-1644)

An abstract of this report was indexed as UCRL-1552 and appears in Nuclear Science Abstracts as NSA 6-703.

1867

AN ATTEMPT TO PRODUCE A THERMO-NUCLEAR REACTION IN DEUTERIUM BY MEANS OF A HIGH CURRENT SPARK DISCHARGE. P. Reynolds and J. D. Craggs. Phil. Mag. (7) 43, 258-60(1952) Feb.

A total of 100 sparks, each carrying a peak current of 285 k amps, was passed through deuterium in the space of 1 hr. No activity in excess of that in the blank experiment was detectable. The total number of neutrons emitted by the sparks must therefore have been less than 6×10^5 and thus a temperature in the spark channel must have been less than $10^{5\circ}$C, which is the minimum temperature necessary for a thermonuclear reaction to occur.

1868

THE PHOTO-ELECTRIC DISINTEGRATION OF THREE- AND FOUR-PARTICLE NUCLEI. J. C. Gunn and J. Irving. Phil. Mag. (7) 42, 1353-68(1951) Dec.

The two-particle and complete photodisintegration cross sections for three- and four-particle nuclei are calculated, using Gaussian and new exponential wave functions. By suitable adjustment of a scale constant, photodisintegration curves can be found with the maximum cross section at any chosen energy above the threshold. For a given position of the maximum the Gaussian wave functions require a bigger nucleus than the exponential, and then give a larger maximum cross section. The theoretical predictions are concerned with the small amount of experimental data available, mainly from the inverse processes of p-D and p-T capture. The exponential wave functions appear to fit more reasonably with this evidence. (auth)

1869

STUDIES OF NUCLEAR COLLISIONS INVOLVING 8 MeV DEUTERONS BY THE PHOTOGRAPHIC METHOD. IV. ANGULAR DISTRIBUTIONS OF THE PARTICLES PRODUCED BY THE BOMBARDMENT OF HELIUM AND OXYGEN. E. J. Burge, H. B. Burrows, W. M. Gibson, and J. Rotblat. Proc. Roy. Soc. (London) 210A, 534-43(1952) Jan. 22.

An experimental technique described previously (Proc. Roy. Soc. (London) 209A, 489(1951)) has been used to study the angular distributions of the products of nuclear processes occurring when He and O are bombarded by 8-Mev deuterons. Results on the elastic scattering of deuterons by He and O nuclei, and on the reactions $He^4(d,p)He^5$ and $O^{16}(d,p)O^{17}$, are presented and discussed. The results for the two groups of protons from the latter reaction allow it to be established that the ground state of O^{17} has spin $\frac{5}{2}$ or $\frac{3}{2}$ and even parity, while the 0.88-Mev excited state has spin $\frac{1}{2}$ and even parity. (auth)

1870

STUDIES OF NUCLEAR COLLISIONS INVOLVING 8 MeV DEUTERONS BY THE PHOTOGRAPHIC METHOD. V. ANGULAR DISTRIBUTIONS OF CHARGED PARTICLES FROM THE BOMBARDMENT OF NITROGEN AND ARGON. W. M. Gibson and E. E. Thomas. Proc. Roy. Soc. (London) 210A, 543-57(1952) Jan. 22.

A technique described in earlier papers has been applied to the study of the nuclear processes which take place when N and A are bombarded by 8-Mev deuterons. Angular distributions have been measured for the elastically scattered deuterons, for two groups of α particles from the reaction $N^{14}(d,\alpha)C^{12}$, for six groups of protons from the reaction $N^{14}(d,p)N^{15}$, and for three groups of protons from the reaction $A^{40}(d,p)A^{41}$. Some information about the spins and parities of the various energy states of the nuclei produced in the (d,p) reactions has been obtained from the results. (auth)

1871

THE SOLUTION OF X-RAY ACTIVATION CURVES FOR PHOTONUCLEAR CROSS SECTIONS. L. Katz and A. G. W. Cameron. Can. J. Phys. 29, 518-44(1951) Nov.

A method is presented for the computation of photonuclear cross sections from their x-ray activation or yield curves. It is based on the photon differences between successive Schiff representations of bremsstrahlung spectra and assumes that the activation curves have smooth first and second derivatives. Artificially prepared activation curves have been satisfactorily solved by this method, and the published photonuclear activation curves [for C^{12}, P^{31}, Fe^{54}, Ni^{58}, Cu^{63}, Cu^{65}, Zn^{64}, Sb^{121}, Sb^{123}, Ta^{181}, S^{32}, and Rb^{87}] determined in this laboratory have been reanalyzed. The resulting cross section curves are in essential agreement with those originally determined; however the new values are believed to be more reliable. New constants for two proposed relationships between (γ,n) "resonance" peak energies and atomic mass number have been determined. Appended to the paper are tables of the Schiff bremsstrahlung spectra for maximum photon energies between 8 and 28 Mev and also of special functions for cross section computations between the same energies. (auth)

1872

SEARCH FOR PRODUCTION OF V^0 PARTICLES BY A 310-MEV BREMSSTRAHLUNG BEAM. G. Cocconi and A. Silverman. Phys. Rev. 84, 1062(1951) Dec. 1.

A search has been made for the production of V^0 particles by 310-Mev bremsstrahlung on C or Pb targets. If V^0 particles disintegrate according to the scheme $V^0 \rightarrow p + \pi^- + Q$ (with $Q \cong 30$ Mev), production by 300-Mev γ rays is energetically possible. The arrangement of a NaI scintillation

counter for detecting protons in coincidence with two stilbene counters for detecting mesons is sketched. The number of coincidences observed never exceeded the rate of chance coincidences; the upper limit of the differential cross section per C nucleus for production of V^0 particles is then 5×10^{-32} cm²/sterad "Q" ("Q" = effective quanta).

1873
RADIATIVE CAPTURE OF THERMAL NEUTRONS BY Li^7. R. G. Thomas. Phys. Rev. 84, 1061-2(1951) Dec. 1.

The cross section for production of radioactive Li^8 by capture of thermal neutrons in Li^7 was determined experimentally to be 33 ± 5 mb (Hughes, Hall, Eggler, and Goldfarb, Phys. Rev. 72, 648(1947)). It is shown in the present paper that this large cross section is qualitatively explainable as the result of a large extra-nuclear contribution to the matrix element of the dipole moment. This extra-nuclear contribution is estimated from data obtained in Li^7-neutron scattering experiments by Adair (Phys. Rev. 79, 1018(1950)) and others.

1874
PHOTOPROTON AND PHOTONEUTRON RELATIVE YIELDS. R. K. Sheline. Phys. Rev. 84, 1064(1951) Dec. 1.

The betatron spectrum of 0- to 48-Mev γ rays was used to induce (γ,n) and (γ,p) reactions in Mg and Si. The ratio of the (γ,p) yield on Si^{29} to the (γ,p) yield on Si^{30} was found to be 1.12 ± 0.16. The ratio of the (γ,p) yield on Mg^{25} to the (γ,p) yield on Mg^{26} is 1.82 ± 0.25. (γ,n) yields on C^{12} and Mg^{24} are also compared with the (γ,p) yields. It appears that a considerable contribution to photonuclear reactions for light elements is made by γ absorption by a single nucleon in a process similar to the photoelectric effect.

1875
THE CROSS SECTION FOR THE RADIATIVE CAPTURE OF PROTONS BY C^{13} AT 129 KEV. Eric John Woodbury and William Alfred Fowler. Phys. Rev. 85, 51-7(1952) Jan. 1.

The cross section for the capture of protons by C^{13} at 129 kilovolts is $\sigma = 5 \pm 1 \times 10^{-33}$ cm². This measurement was made possible through the use of a scintillation counter that had an over-all detection efficiency of 8.7%, and a pulsed ion source that had a peak proton current capability of 1 ma. A rough analysis of the radiation shows that 80% is due to the transition to the ground state of N^{14}, while the exact nature of the remaining 20% was not determined. (auth)

1876
PHOTONUCLEAR CROSS SECTIONS IN ALUMINUM AND MAGNESIUM. L. Katz and A. G. W. Cameron. Phys. Rev. 84, 1115-19(1951) Dec. 15.

Cross-section curves have been measured as functions of photon energy for the reactions $Al^{27}(\gamma,n)Al^{26}$, $Mg^{24}(\gamma,n)Mg^{23}$, $Mg^{25}(\gamma,p)Na^{24}$, and $Mg^{26}(\gamma,p)Na^{25}$. These curves exhibit the peaked shape characteristic of photonuclear reactions, the maximum cross sections being 8.1, 9.8, 14.8, and 19.3 mb, respectively. The (γ,p) peak positions occur about 2 Mev higher than those of the (γ,n) reactions, and their cross sections as indicated above are considerably larger. It is shown that these peaked shapes result from a peaking of the photonuclear absorption cross sections. The larger values of the (γ,p) peak positions and cross sections may be explained as resulting from a direct interaction between high-energy photons and nuclear protons. (auth)

1877
THE REACTION $Mn^{55}(p,n)Fe^{55}$. J. J. G. McCue and W. M. Preston. Phys. Rev. 84, 1150-4(1951) Dec. 15.

The neutron spectrum from the reaction $Mn^{55}(p,n)Fe^{55}$ has been examined from the threshold to a proton bombarding energy of 2.85 Mev. The reaction threshold was found to be 1.002 ± 0.010 Mev. Many resonances were found in the neutron yield; these correspond to excited states of Fe^{56}. A limited region was studied with a resolution width of about 2 kev, and an upper limit of 4.5 kev was found for the average observed level spacing. (auth)

1878
A NaI(Tl) SCINTILLATION SPECTROMETER STUDY OF PROTON GAMMA-RAY COINCIDENCES. Robert C. Allen, John E. May, and Waldo Rall. Phys. Rev. 84, 1203-6(1951) Dec. 15.

A proton-γ coincidence study of the $Al^{27}(\alpha,p)Si^{30}$ reaction has been made using a NaI(Tl) scintillation spectrometer. The decay scheme of the excited states of Si^{30} has been established and the energies of the γ rays have been measured. The decay of the third excited state was found to be a double cascade process: from the third to the second to the ground state, and from the third to the first to the ground state. The γ-ray energies in the former process were determined to be 1.28 ± 0.06 Mev and 3.66 ± 0.15 Mev. The energies of both the γ rays in the latter transition were found to be between 2.2 and 2.7 Mev. Measurements on the second excited state showed that the decay was direct to the ground state, the energy of the γ rays being 3.63 ± 0.15 Mev. The γ-ray energy from the first excited state was established to be 2.32 ± 0.05 Mev. (auth)

1879
THE THICK TARGET YIELD OF THE REACTION $C^{12}(p,\gamma)N^{13}(\beta^+)C^{13}$. John D. Seagrave. Phys. Rev. 84, 1219-21(1951) Dec. 15.

The yield of N^{13} from a thick C target bombarded with protons of energy up to 2.5 Mev has been studied by detecting annihilation quanta with a scintillation crystal. Resonances at 0.45 and 1.70 Mev are confirmed, and independent values are obtained for their relative and absolute intensities. (auth)

1880
EVIDENCE FOR EXCITED STATES OF Be^8 AND Li^7 IN THE DISINTEGRATION OF BERYLLIUM BY DEUTERONS. Pierre Cüer and Jean J. Jung. Compt. rend. 234, 204-6 (1952) Jan. 7. (In French)

A detailed nuclear-emulsion study of the spectrum of disintegration of Be^9 by 0.3- to 1.5-Mev deuterons has given evidence for the reaction $Be^9(d,t)Be^{8*}$, $Be^{8*} \rightarrow 2\alpha$, $E_{exc} \approx 3$ Mev and has confirmed the appreciable production of Li^{7*}, $E_{exc} \approx 4.65$ Mev. In the latter case the transition $Li^{7*} \rightarrow t + \alpha$ has been established. These schemes are opposed to the proposals of Inglis (Phys. Rev. 78, 104(1950)) that the reaction $Be^9(d,2\alpha)t$ occurs without formation of intermediate excited states of Be^8 and Li^7.

1881
ON EVIDENCE FOR A DIFFERENCE BETWEEN LIGHT AND HEAVY NUCLEI IN CHARGE EXCHANGES WITH VERY FAST NUCLEONS. Pierre Cüer and Jean Combe. Compt. rend. 234, 82-4 (1952) Jan. 2. (In French)

Nuclear emulsions were bombarded with 90- and 270-Mev neutrons and 340-Mev protons in the Berkeley synchrocyclotron. A fundamental difference was observed in the reactions of the light (C, N, O) and heavy (Ag, Br) elements, with respect to charge exchange and angular distribution of emergent charged particles. The authors' theory of instantaneous α substructure in the light nuclei (Phys. Rev. 80, 906(1950)) satisfactorily explains these and other phenomena in the high-energy domain.

PARTICLE ACCELERATORS

1882
Oak Ridge National Lab., Y-12 Area
FIXED FREQUENCY CYCLOTRON THEORY, by Bernard L. Cohen. Apr. 4, 1951. Decl. Feb. 1, 1952. 138p. (AECD-3301; Y-757)

The motion of an ion in a fixed-frequency cyclotron is investigated in detail. Numerical results obtained for the ORNL cyclotron are given. The theory for both the horizontal- and vertical-motion cyclotron is developed. The electric-field components in the horizontal and vertical directions are calculated for cyclotron geometry with various ratios of dee height to dee gap. These are used in the calculations of the two previous sections. An expression is obtained for the minimum voltage required to obtain a beam of a given energy as a function of the field shape and the mass and charge of the ions being accelerated. This is then solved to get the maximum energy obtainable from a given voltage. Some considerations concerning the best magnetic-field shape for a fixed-frequency cyclotron are presented. Phase shifts and orbital instability introduced by the electric field and imperfections in the magnetic field are investigated and found not to have an appreciable effect on the current.

1883

Institute for Nuclear Studies, Univ. of Chicago
HIGH ENERGY ACCELERATOR DESIGN, sect.IA of NUCLEAR PHYSICS AND THE PHYSICS OF FUNDAMENTAL PARTICLES; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, SEPTEMBER 17 TO 22, 1951, by Jay Orear, A. H. Rosenfeld, and R. A. Schluter, eds. [nd] 11p. (NP-3591(sect.IA))

Synchrotron design in general and the Brookhaven cosmotron in particular are discussed by L. J. Haworth. Brief descriptions of other accelerators are given as follows: Harwell synchrocyclotron, by T. G. Pickavance; Rochester synchrocylotron, by S. W. Barnes; Carnegie Institute of Technology synchrocyclotron, by E. C. Creutz; Uppsala synchrocyclotron, by Helge Tyren; Chicago synchrocyclotron, by J. Marshall; and the General Electric nonferromagnetic synchrotron, by James Lawson.

1884

THE PRESSURE ELECTROSTATIC GENERATOR OF THE UNIVERSITY OF ZÜRICH. H. Bömmel, H. H. Staub, and H. Winkler. Helv. Phys. Acta 24, 632-3(1951) Dec. 31. (In German)

The Lauritsen-type accelerator is described briefly. The vertical pressure tank is 3 m in height and 156 cm in internal diameter. Operating pressure is 10 atm of dry air. A pressure of $<10^{-5}$ mm Hg is reached in the vacuum ion-acceleration tube. About 1.8 Mv has been attained.

1885

THE ANGULAR DISTRIBUTION OF SYNCHROTRON TARGET RADIATION. E. G. Muirhead, B. M. Spicer, and H. Lichtblau. Proc. Phys. Soc. (London) 65A, 59-63(1952) Jan.

Some measurements on the angular distribution of thin-target radiation produced in a synchrotron are reported using ionization chambers to measure the x-ray intensity. Quantitative agreement has been obtained with the bremsstrahlung–multiple scattering theories of Schiff and Lawson for the case of a platinum target in the range of electron energies of 10–14 Mev.

1886

A 200 KV. HIGH TENSION SET FOR THE ACCELERATION OF H^3 AND He^3. K. W. Allen, E. Almqvist, J. T. Dewan, and T. P. Pepper. Can. J. Phys. 29, 557-68(1951) Nov.

A 200-kv high-tension set suitable for the acceleration of H^3 and He^3 is described. Special features incorporated in the accelerator include a r-f type ion source capable of giving large beam currents with low gas consumption, a differential pumping system for recovering the gas used by the ion source, and an electronic stabilizer which reduces voltage fluctuations to a negligible value. (auth)

RADIATION ABSORPTION AND SCATTERING

1887

Institute for Nuclear Studies, Univ. of Chicago
SCATTERING OF NUCLEAR PARTICLES, AND NUCLEAR FORCES, sect.IIB of NUCLEAR PHYSICS AND THE PHYSICS OF FUNDAMENTAL PARTICLES; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, SEPTEMBER 17 TO 22, 1951, by Jay Orear, A. H. Rosenfeld, and R. A. Schluter, eds. [nd] 22p. (NP-3591(sect.IIB))

E. Segrè summarized experimental data on low- and high-energy scattering for the n-p and p-p systems and interpreted the data in terms of potential wells and short-range interactions. J. M. Cassels described p-p and p-d scattering experiments at Harwell with 146-Mev protons. T. G. Pickavance described neutron experiments with the 110-in. Harwell cyclotron. The energy spectrum of neutrons produced in the forward direction by 171-Mev protons on Be is shown, and the present state of measurements at Harwell of the n-p differential and total scattering cross sections is presented. Graphs are shown of the angular distribution of neutrons from Be and the energy spectra of evaporation neutrons produced by proton bombardment of W and C. Recent cross-section results for p-d scattering at 240 Mev. were given by R. Marshak. G. Breit discussed recent advances in the interpretation of scattering data. Graphs illustrate the effect of the meson potential on the function f, the comparison of experiment for a bombarding energy <5 Mev with theoretical expectation for a Yukawa potential, and an over-all comparison of theory and experiment up to E = 30 Mev in the form of a direct f plot. J. H. Williams discussed experiments on polarization and scattering of protons by He, the results of which indicate that the Li^5 doublet is inverted ($P_{3/2}$ is the lower).

1888

INELASTIC SCATTERING OF DEUTERONS. R. Huby and H. C. Newns. Phil. Mag. (7) 42, 1442-5(1951) Dec.

The total cross section of some nuclei for inelastic scattering of deuterons seems much larger than would be expected on the theory of compound nucleus formation. The excitation of the 1.38-Mev level in Mg^{24} is discussed as an example. A mechanism is proposed to account for the size of of the cross section and the angular distribution. It is assumed that only one of the constituents of the deuteron, say the neutron, interacts with the nucleus, the proton being outside of the range of the nuclear forces. The neutron interacts at the surface of the nucleus, exciting it and then "bouncing off," the deuteron emerging as a whole having been inelastically scattered. The differential cross section is derived from the wave functions. By comparison of the theoretical cross sections with the experimental angular distribution of inelastically scattered deuterons, information can be obtained about the spins and parities of nuclear states.

1889

ON THE EFFECT OF ELECTRON SCATTERING ON THE SPATIAL DISTRIBUTION OF X-RAY BREMSSTRAHLUNG. O. Blunck. Ann. Physik (6) 9, 373-80(1951). (In German)

General considerations and an extension of the scattering theory of Goudsmit and Saunderson (Phys. Rev. 57, 24(1940); 58, 36(1940)) lead to an expression for the spatial intensity distribution of x-ray bremsstrahlung from scattering, back-scattering, and energy loss of electrons bombarding an anticathode. Good agreement is obtained between the theory and the measurements of Sesemann (Ann. Physik (5) 40, 66 (1941)) on Be bombarded with 90- and 150-kev electrons.

1890

ON THE EFFECT OF ELECTRON SCATTERING ON BREMSSTRAHLUNG IN THIN ANTICATHODES. O. Blunck. Z. Physik 130, 632-40(1951). (In German)

Measurements of the bremsstrahlung from thin anticathodes in the vicinity of the limiting frequency and in the direction of incidence of the electron do not agree with Sommerfeld's theory (Atombau und Spektrallinien, 2nd. ed., vol. II, p.499ff), nor do measurements of the degree of polarization. It is shown that scattering of the electrons in the anticathode cannot explain these deviations. In addition, a scattering theory which includes the path and magnitude of single scattering is sketched.

1891

ON THE ENERGY LOSS OF HIGH-ENERGY ELECTRONS IN THIN LAYERS. O. Blunck and K. Westphal. Z. Physik 130, 641-9(1951). (In German)

The probability distribution of energy loss by fast electrons through ionization and radiation has been calculated on the assumption that the electron penetrates only thin layers; that is, the average energy loss is small compared to the incident homogeneous energy. The calculated distribution shows that ionization is the determining factor in energy loss at arbitrary high energy, in contradiction to Eyges (Phys. Rev. 76, 264(1949); 77, 81(1950)). Only with thick layers can agreement with Eyges be expected.

1892

ANGULAR DISTRIBUTION OF ELASTICALLY SCATTERED DEUTERONS AND DISINTEGRATION PROTONS FROM THE BOMBARDMENT OF BERYLLIUM BY 7.7 Mev DEUTERONS. F. A. El-Bedewi. Proc. Phys. Soc. (London) 65A, 64-8(1952) Jan.

The deuteron beam from the Liverpool 37-in. cyclotron was used to bombard a thin Be foil in a vacuum chamber. The photographic plate method was employed in detecting the charged particles emitted from the reaction. The angular distribution of the elastically scattered deuterons shows a secondary maximum at 65°. Angular distributions of the two longest-range proton groups are compared with the recent theories of the angular distributions of the (d,p) and (d,n) reactions. The results indicate that both the ground state and first excited state of the residual nucleus Be^{10} have even parity and spin either 0, 1, 2, or 3. (auth)

1893

LIMITATIONS ON MASS CHANGES OF SCATTERED NUCLEONS. G. Breit and H. M. Jones. Phys. Rev. 84, 1054 (1951) Dec. 1.

The collision of two particles of equal mass is considered in an attempt to determine the degree to which scattering experiments performed by the coincidence method exclude changes in mass of protons on scattering. It is shown that measurements of the scattering angle to within 1° would in certain cases limit the mass within $\sim\pm 1.7$ Mev for 100-Mev incident energy.

1894

HIGH ENERGY NUCLEON-NUCLEON SCATTERING. G. Breit. Phys. Rev. 84, 1053-4(1951) Dec. 1.

Examples are mentioned in which attempts to account for high-energy nucleon-nucleon scattering by means of a symmetric hamiltonian have met with difficulty. The agreement between theoretical and experimental meson mass in p-p and p-n interactions is poor. The approximate independence of the p-p scattering cross section on the scattering angle is considered, and it is suggested that there appears to be no compelling reason for supposing that at energies comparable with the rest mass energy of the π meson the collision process does not change the nature of the protons. If, after collision, the protons are not identical, they can exist in ^3S as well as ^1S states. If collisions produce isomeric states it would be natural to suppose that the formation occurs through an intermediate state of the two-nucleon system, requiring for its formation a relative kinetic energy of the order of the meson mass energy. The observed flatness of the cross-section energy curve for p-p scattering would be the result of compensation of the decrease in scattering of identical protons and an increase in scattering of non-identical ones.

1895

SCATTERING OF FAST NEUTRONS FROM O^{16}. E. Baldinger, P. Huber, and W. G. Proctor. Phys. Rev. 84, 1058(1951) Dec. 1.

The differential neutron cross sections of O^{16} have been measured for neutrons of 2 to 4 Mev by means of an ionization chamber containing O_2 gas. The energy spectrum of collision-recoil O nuclei is linearly related to the angular distribution of the scattered neutrons. The data were analyzed by using the expressions for scattering from potentials having a spin-orbit coupling term. A scattered wave phase behavior was found which satisfactorily predicts the total and differential cross section at each energy. This phase behavior substantiates the idea that the negative resonance near 2.35 Mev is associated with an $S_{1/2}$ level of the compound nucleus, while the broad rise at 3.5 Mev is caused by two broad overlapping resonances. Resonances in the cross section near 1.9 and 4.4 Mev are both caused by $P_{1/2}$ levels. A level identification is proposed for O^{17}.

1896

HIGH ENERGY ELASTIC PROTON-DEUTERON SCATTERING. Geoffrey F. Chew. Phys. Rev. 84, 1057-8(1951) Dec. 1.

The impulse approximation is applied to analysis of elastic p-d scattering experiments reported by Schamberger (Phys. Rev. 83, 1276(1951)) and Stern (UCRL-1440(1951)) for proton energies of 240 and 95 Mev, respectively. By making use of n-p and p-p scattering data at corresponding energies and by assuming S scattering only and no spin dependence except that forced by the Pauli principle in the p-p system, the author has developed a formula for the angular distribution of p-d scattering (c.m. system). The angular-distribution curve ($d\sigma_{pd}^{el}/d\omega$ vs. θ) obtained from the formula is compared with experimental values.

1897

RANGE STRAGGLING OF A NONRELATIVISTIC CHARGED PARTICLE. H. W. Lewis. Phys. Rev. 85, 20-4(1952) Jan. 1.

The validity of the gaussian approximation for the range straggling, due to ionization and excitation, of a nonrelativistic charged heavy particle is investigated. Exact solutions are obtained which show that, in comparison with the usual theory, (a) the mean range of a particle is slightly increased; (b) the range distribution has a tail in the direction of shorter-than-average range; (c) the most probable range is slightly longer than the mean range. First a fictitious problem is solved, and then the transition to the real world is made. (auth)

1898

POLARIZATION OF SCATTERED QUANTA. J. I. Hoover, W. R. Faust, and C. F. Dohne. Phys. Rev. 85, 58-9(1952) Jan. 1.

An experimental study of the polarization effect of doubly scattered Co^{60} γ rays as a function of the angle of scattering has been made using scintillation detectors and coincidence counting. Although there are large statistical deviations from the theoretical values at certain points, a comparison between the experimental and theoretical values indicates no serious disagreement. (auth)

1899

STUDY OF THE MULTIPLE SCATTERING OF FAST CHARGED PARTICLES IN A GAS. II. (NEGATIVE AND POSITIVE BETA-PARTICLES). Gerhart Groetzinger, Watts Humphrey, Jr., and Fred L. Ribe. Phys. Rev. 85, 78-9(1952) Jan. 1.

The experimental study of the multiple scattering of electrons in a gas has been extended to include electrons

of momenta up to 10,200 gauss-cm. The results of these measurements are compared with predictions of various theories of multiple scattering. Furthermore, a parallel investigation of the multiple scattering of positrons has been carried out over the momentum range between 2000 and 9000 gauss-cm. The rms angle of multiple scattering for the positrons is found to be approximately ten per cent less than for electrons of the same momentum. (auth)

1900

THE PRODUCTION OF POLARIZED PROTONS AND THE INVERSION OF ENERGY LEVELS OF THE $P_{1/2} - P_{3/2}$ DOUBLET IN Li^{5*}. M. Heusinkeveld and George Freier. Phys. Rev. 85, 80-4(1952) Jan. 1.

Spin-orbit coupling in the scattering of protons by helium is expected to result in polarization of the scattered proton beam. This effect has been established by performing a double scattering experiment, in the form of a polarizer-analyzer arrangement, and measuring the amount of polarization. These data, used in conjunction with the phase-shift analysis of the single scattering differential cross-section data, give conclusive evidence that the $P_{1/2}$ and $P_{3/2}$ energy levels in the compound nucleus of Li^{5*} are inverted. (auth)

1901

THE RANGE OF 18-MEV PROTONS IN ALUMINUM. E. L. Hubbard and K. R. MacKenzie. Phys. Rev. 85, 107-11(1952) Jan. 1.

The circulating beam of protons in the UCLA 41-in. cyclotron was multiply scattered upward by a strip of Th suspended vertically inside the dee. The energy of the scattered beam was defined by the Th strip and two slits in the magnetic field of the cyclotron. From a plot of the magnetic field along the path of the scattered protons, the mean energy was determined to be 18.00 ± 0.02 Mev. By determining the thickness of Al that stopped half the incident beam, the mean range was found to be 447.0 ± 0.5 mg/cm².(auth)

1902

ON THE THEORY OF MULTIPLE SCATTERING, PARTICULARLY OF CHARGED PARTICLES. Ming Chen Wang and Eugene Guth. Phys. Rev. 84, 1092-1111(1951) Dec. 15.

The general theory of the elastic multiple scattering of particles with a strongly anisotropic scattering function is investigated without making the small-angle approximation. The rigorous transport equation is used and approximations are introduced at a later stage. The paper consists of four parts. In the first part the general formulation of the problem is given. The approximations involved in the existing theories of small-angle forward scattering are discussed in some detail. In the second part the spherical harmonic method is formulated in a manner so as to permit an explicit expression for the general nth approximation. There is an ambiguity both in (a) the way of defining successive approximations and in (b) the way of introducing approximate boundary conditions. Choice of (b) was made to give the best approximation to the exact solution of the Schwarzschild-Milne problem. In the third part it is shown that the choice of (a) for the spherical harmonic method leads to the same final formulas as the gaussian quadrature method. The relation of these two methods is discussed in detail. In the fourth part the problem of anisotropic multiple scattering is reduced to a quasi-isotropic one by using a generalized Goudsmit-Saunderson type distribution function (defined also for back scattering) as a first approximation. Three different methods are given for forward scattering (including large angles).

1903

COHERENT NEUTRON-PROTON SCATTERING BY LIQUID MIRROR REFLECTION. M. T. Burgy, G. R. Ringo, and D. J. Hughes. Phys. Rev. 84, 1160-4(1951) Dec. 15.

A measurement of the coherent n-p scattering amplitude, utilizing total reflection of slow neutrons from a liquid hydrocarbon, was first reported in 1950. As the result ($-3.75 \pm 0.03 \times 10^{-13}$ cm) was significantly different from existing values, the measurements have been continued with a series of liquids in order to investigate systematic errors and to improve the accuracy. Final measurements have now been made utilizing a series of carefully purified hydrocarbon liquids, and a method in which no measurement of neutron wavelength is necessary. The ratio of the amplitude of H to that of C has been determined to 0.3% and the final value of the H amplitude, including the error (0.5%) in the C amplitude, is ($-3.78 \pm 0.02 \times 10^{-13}$ cm (standard error)). (auth)

1904

ELASTIC SCATTERING OF ELECTRONS. Herman Feshbach. Phys. Rev. 84, 1206-10(1951) Dec. 15.

This paper considers the effect of the finite size of the nucleus on the electrostatic scattering of electrons whose energy greatly exceeds their rest mass. It is shown that the phase shift for a given total electron angular momentum j, is dependent of their orbital angular momentum l; that the phase shift depends on the parameter R describing the extension of the nuclear charge only through the combination pR where p is the electron momentum. If the additional assumption $pR \ll 1$ is made, it may be shown that the phase shift η_0 for $j = \frac{1}{2}$ electron is independent of the model describing the distribution of nuclear charge. For models for which the potential is finite at the origin, η_0 depends upon the model only through the volume integral of the potential over the nucleus. (auth)

1905

ELECTRON CAPTURE AND LOSS CROSS SECTIONS FOR PROTONS PASSING THROUGH AIR. H. Kanner. Phys. Rev. 84, 1211-18(1951) Dec. 15.

Measurements have been made of the electron-loss cross section σ_1 and the electron-capture cross section σ_c for hydrogen beams in air. σ_1 varied from 24.4×10^{-17} cm² at 40.8 kv to 13.6×10^{-17} cm² at 325 kv. σ_c varied from 20.8×10^{-17} cm² at 31.4 kv to 2.7×10^{-17} cm² at 122 kv. In the ranges quoted, the cross sections were well represented by the formulas,

$$\sigma_1 = (24.54 - 0.866E/E_0) \times 10^{-17} \text{ cm}^2,$$

$$\sigma_c = [41.1 \exp(-0.562E/E_0)] \times 10^{-17} \text{ cm}^2,$$

where $E_0 = 24.8$ kv, the energy of a proton having the velocity $e^2/\hbar$. By extrapolation of the data, σ_1 was found to equal σ_c at energy E_0. (auth)

RADIOACTIVITY

1906

Argonne National Lab.

THE β-SPECTRA OF Pu^{239}, Pu^{240}, Pu^{241}, AND Sm^{151}, by F. Wagner, Jr., M. S. Freedman, and D. Engelkemeir. Nov. 1951. Decl. Feb. 8, 1952. 3p. (AECD-3304; ANL-HDY-697(Rev.))

The β spectrum of 10-yr Pu^{241} was run on a sample of radiochemically pure Pu containing the isotopes Pu^{239}, Pu^{240}, and Pu^{241}, isotopically enriched in Pu^{241} by pile-neutron irradiation. The isotopic composition was determined mass spectrographically. The β spectrum was taken on a double-lens spectrometer; the detector used was an atmospheric-pressure methane flow proportional counter. The Kurie plot of the Pu^{241} sample exhibited an allowed shape (log ft = 5.7) from $E_0 = 20.5$ to 14 kev, which indicates a single-step process for the β decay–orbital rearrangement event. Several conversion lines between 23 and 53 kev were found and assigned among the three isotopes. A $Sm^{151}\gamma$ of 20.5

kev was observed by means of a NaI scintillation counter, but no evidence was found for conversion lines down to 11 kev. The Kurie plot for Sm^{151} was linear from E_0 = 75.5 kev down to 13 kev.

1907

Argonne National Lab.

A STUDY OF THE GAMMA RAYS ASSOCIATED WITH SELECTED NEUTRON-INDUCED RADIOACTIVITIES, by W. C. Rutledge, J. M. Cork, and S. B. Burson. Dec. 3, 1951. 98p. (ANL-4735)

The energies of many new γ rays are determined to ±0.3% or better in a continued study using magnetic spectrographs. A new dynamic vacuum O-ring seal on the fast-entry camera permits the study of activities with half lives as short as 5 or 10 sec. By applying experimentally determined corrections for the geometry of the camera and for the sensitivity of the photographic emulsion to electrons of different energies, it is often possible to obtain the K/L ratios of the prominent γ rays to ±10% or better. In a comparison of the results of the photographic method with those of a constant-radius β spectrometer, excellent agreement is obtained. Energy level schemes are presented for the excited nuclei on the basis of mathematical sum identities, coincidence measurements, and changes in spin and parity determined from the type of radiation. The general results obtained are summarized for the following isotopes: Sc^{46m}, Se^{77m}, Se^{79m}, Se^{81m}, Se^{81}, Se^{83}, Nd^{147}, Nd^{149}, Nd^{151}, Pm^{149}, Pm^{151}, Sm^{145}, Sn^{151}, Sm^{153}, Sm^{155}, Eu^{155}, Mo^{101}, Tc^{101}, and Th^{233}.

1908

Knolls Atomic Power Lab.

ACTIVATION OF A FLUID CIRCULATING THROUGH A NEUTRON FLUX, by Gerard A. Allard. Dec. 14, 1951. 16p. (KAPL-665)

An exact solution is derived for the activation of an element flowing through a single-velocity neutron flux during a constant fraction of a closed circulation cycle. Some simplifications are indicated which lead to known formulas. (auth)

1909

Institute for Nuclear Studies, Univ. of Chicago

BETA-RAY SPECTRA AND NEUTRINOS, sect.IVA of NUCLEAR PHYSICS AND THE PHYSICS OF FUNDAMENTAL PARTICLES; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, SEPTEMBER 17 TO 22, 1951, by Jay Orear, A. H. Rosenfeld, and R. A. Schluter, eds. [nd] 24p. (NP-3591(sect.IVA))

Details of the talk by J. M. Robson on radioactivity of the neutron may be found in Phys. Rev. 83, 349-58(1951). James S. Allen spoke on nuclear recoils resulting from the decay of Be^7 and A^{37}. Part of his talk has been published in Phys. Rev. 81, 381-5(1951). Eight figures are shown in the conference report. Chalmers W. Sherwin described experiments on the emission of a neutrino from P^{32} (see Phys. Rev. 82, 52-7(1951)). S. R. de Groot spoke on the theory of β decay. J. C. Jacobsen described a simple experiment to demonstrate the angular correlation between electron and neutrino in the β decay of Kr^{89}. C. S. Wu discussed recent experiments on forbidden β spectra and evidence for a tensor interaction in β decay. O. R. Frisch commented that the spins of Rb^{86}, Na^{24}, and Cs^{134} have recently been measured as 2, 4, and 4, respectively. The RaE spectrum was discussed by Wu, and R. E. Marshak reported fitting the spectrum to a Fermi plot by a mixture of tensor and pseudoscalar interactions. M. Goldhaber discussed the decay schemes of isotopes with mass number 85 and suggested a possible modification of β-decay theory. A. C. G. Mitchell spoke on the metastable state of Se^{77} (see Phys. Rev. 83, 955(1951)).

1910

Carnegie Inst. of Tech.

HALF-LIVES OF POSITRONS IN CONDENSED MATERIALS, by S. De Benedetti and H. Richings. Nov. 23, 1951. 6p. (NYO-915)

Using scintillation counters and a fast coincidence circuit, the relative half life of positrons decaying in various condensed materials has been measured. The only solids to give measurably life times were certain chemically stable insulators. Other types of solids, such as metals, were unmeasurable. (auth)

1911

Palmer Physical Lab., Princeton Univ.

GAMMA RADIATION OF C^{10}, by R. Sherr and J. Gerhart. [nd] 1p. (NYO-3005)

The γ-ray spectrum of C^{10} produced by the $B^{10}(p,n)$ reaction has been examined with a NaI scintillation spectrometer. In addition to 511-kev annihilation radiation, γ rays of energy 720 ± 15 kev and 1045 ± 20 kev were obtained. The photopeak of the 1045-kev radiation is superimposed on a continuous distribution of hard radiation which was found also in C^{11}, Ne^{19}, and A^{35}. Absence of a significant Z dependence on absorbing the positrons in different materials and the fact that the hardness increases with positron energy suggest that the continuous radiation is to be attributed to annihilations of positrons in motion. The intensities of the 720 and 1045 kev lines correspond to 1.0 0.1 and 0.021 ± 0.005 γ rays per positron of C^{10}. From the known levels of B^{10}, these γ rays correspond respectively to β^+ transitions to the first (713 kev) and second (1740 kev) excited states, the latter reaching the ground state by cascade through the former. The ratio of the intensities expected on the basis of the f values for allowed transitions is 0.07. The possibility that the existence of the 1045 kev line may be evidence for an allowed $0-0$ β^+ transition will be discussed. (Entire report)

1912

THE HALF-LIFE OF IRIDIUM 192. J. Kastner. Can. J. Phys. 29, 480-1(1951) Nov.

A Lauritsen electroscope was used to compare the intensity of an Ir^{192} source with a Ra standard. The result of a least squares fitting of the decay curve was a half life of Ir^{192} of 74.37 ± 0.07 days. (auth)

1913

SOME STUDIES IN ANGULAR CORRELATION. E. K. Darby. Can. J. Phys. 29, 569-76(1951) Nov.

The β-γ-angular correlation in Sb^{124} has been measured as a function of β energy using a 12-channel kick-sorter and a thick crystal counter as β detector. The differential correlation coefficient a(E) has been found to change from −0.17 at 1 Mev to −0.44 at the end of the β spectrum. When integrated numerically over all β energies greater than 1 Mev the integrated angular correlation coefficient so obtained agrees with the value measured directly. Experiments on the γ-γ-angular correlation in Co^{60} and Sc^{46} performed with the same apparatus are in agreement with previous results of other workers. (auth)

1914

FORBIDDEN BETA-SPECTRA OF Sb^{124} AND I^{124}. Lawrence M. Langer. Phys. Rev. 84, 1059(1951) Dec. 1.

The 2.291-Mev β spectrum of Sb^{124} and the 2.2-Mev β^+ decay of I^{124} are discussed with respect to half lives and degrees of forbiddenness. Both apparently decay to the 0.60-Mev level in Te^{124}, to which the assignment I = 1, is proposed. The high comparative half life for the Sb^{124} transition (log ft = 10.1) then results from its being "ΔL-forbidden" in addition to its involving a parity change and a total angular momentum change of 2. The I^{124} transition is apparently first-forbidden (log ft = 8.1).

1915

THE DECAY OF Bi^{207}. M. A. Grace and J. R. Prescott. Phys. Rev. 84, 1059(1951) Dec. 1.

Bi^{207} has been prepared by proton bombardment of Pb foil and chemical extraction of the Bi as oxychloride. Measurements using a NaI(Tl) scintillation detector showed prominent γ-ray lines at 0.56 ± 0.03 Mev and 1.1 ± 0.05 Mev, of about equal intensity. Coincidence measurements indicated that at least half the 0.56- and 1.1-Mev γ rays are in cascade. The 1.1-Mev γ is M4 and precedes the 0.56-Mev γ, which is E2.

1916

A FURTHER STUDY OF THE NATURAL ACTIVITY OF LANTHANUM. R. W. Pringle, S. Standil, H. W. Taylor, and G. Fryer. Phys. Rev. 84, 1066-7(1951) Dec. 1.

A scintillation spectrometer has been used to study the γ spectrum of La^{138} from a highly purified La_2O_3 source. A 5-channel kicksorter gave 3 lines, attributed to γ rays of 535 ± 15, 807 ± 15, and 1390 ± 30 kev, plus a Compton edge at ~1100 kev. The relative γ intensities were 0.3: 0.65: 1, respectively. A decay scheme is proposed in which the γ rays are associated with K-capture decay to Ba^{138}, the 1390-kev γ being the cross-over transition. An x ray of energy 32 ± 1 kev was found to be associated with the La^{138} decay. It is estimated that the half life of La^{138} is $\sim 2.0 \times 10^{11}$ years and that its activity is ~0.6 γ quanta/sec-g of all energies.

1917

COINCIDENCE STUDIES IN THE DECAY OF La^{140}. Berol L. Robinson and Leon Madansky. Phys. Rev. 84, 1067-8(1951) Dec. 1.

Coincidence studies of the decay of La^{140} using techniques based on the proportional properties of scintillation detectors have indicated that the 1.60-Mev γ is in coincidence with the most energetic (2.26 Mev) β rays and that the 1.60- and 0.82-Mev γ's are coincident. The angular correlation between these two γ's was also investigated, and results are tabulated. A partial decay scheme is proposed, spins being assigned as follows on the basis of the angular correlation measurements: ground level, 0; 1.60-Mev level, 2; and 2.42-Mev level, 4.

1918

A SEARCH FOR GAMMA-RAYS FROM THE 4.8-Mev LEVEL IN Li^7. H. E. Gove. Phys. Rev. 84, 1059(1951) Dec. 1.

In order to make a preliminary determination as to whether Li^7 in the 4.8-Mev excited state decays by γ emission, a comparison was made between the γ spectrum from the reaction $C^{12}(p,p')C^{12*} \rightarrow C^{12} + \gamma + 4.5$ Mev and that from $Li^7(p,p')Li^{7*}$, Q = −4.8 Mev, using the 8-Mev protons from the MIT cyclotron. The γ spectrum was measured alternately from thin, unbacked C and Li targets using a NaI(Tl) scintillation counter located at 90° to the beam. The carbon γ spectrum showed a pronounced peak corresponding to the 4.5-Mev γ ray, whereas in the case of the Li target there was no evidence of a γ peak in the 4.8-Mev region above a low background of very high energy γ's. The inelastic proton groups from the two targets were roughly equal in intensity, as measured in a double proportional counter. It appears that the preferred mode of decay for the 4.8-Mev level in Li^7 is not by γ emission but by particle emission — probably breaking up into He^4 and H^3. (Entire Letter)

1919

INTERNAL CONVERSION IN Pr^{144}, In^{114}, Ba^{137}, AND Cd^{110}. W. C. Kelly. Phys. Rev. 85, 101-3(1952) Jan. 1.

Beta-ray spectrometer measurements have been made of the internal conversion ratio α_K/α_L for four nuclear transitions. Values obtained are 5.3 ± 0.1 for the 132-kev transition in Pr^{144}; 1.30 ± 0.05, 192 kev, In^{114}; 4.57 ± 0.05, 662 kev, Ba^{137}; and 14 ± 2, 656 kev, Cd^{110}. Tentative assignments of multipolarity are given. (auth)

1920

EFFECTS OF THE RECOIL ON ALLOWED β-TRANSITIONS. O. Kofoed-Hansen. Phil. Mag. (7) 42, 1411-16 (1951) Dec. (cf. NSA 2-626 and 5-7206)

The recoil corrections to the shape of the Fermi distribution for the β spectrum are calculated, and it is concluded that they are of the same order of magnitude as other effects which are usually neglected. In the special case of the β decay of the neutron some particular effects from the recoil appear in the matrix element and give rise to the exclusion of the pseudoscalar coupling case as responsible for the β decay of the neutron.

1921

FINE STRUCTURE IN THE U^{238} DECAY. Barbara Zajac. Phil. Mag. (7) 43, 264-6(1952) Feb.

Ilford G5 nuclear emulsions have been impregnated with natural uranium in solution as the complex ammonium citrate, adjusted to pH 8. The developed plates were examined for the occurrence of electron tracks in association with the tracks of the α particles of the three isotopes of natural U. A statistical survey showed that such electron tracks were associated with 29.1 ± 1.3% of all U α-particle tracks. Measurements were made on 776 α-particle tracks to give distribution of ranges for "all" α particles, and on the tracks of 635 α particles having associated electrons. The two range distributions were very similar. In both two main peaks occurred at about 16.5 μ and 19.5 μ emulsion range and there were signs of a small (incompletely resolved) peak at about 17.5 μ range due to the 4.4 Mev α particles of U^{235}. The similarity of the two α-particle range distributions showed conclusively that secondary electrons follow the α disintegration of U^{238} as they do for U^{234}.

1922

THE APPLICATION OF PROPORTIONAL γ-RAY COUNTERS TO THE DETERMINATION OF THE DECAY SCHEME OF I^{131}. P. E. Cavanagh. Phil. Mag. (7) 43, 221-30(1952) Feb.

A naphthalene–anthracene crystal has been used to separate the high energy γ rays in I^{131} from the main low energy component. Coincidence absorption measurements with β rays and the high energy γ rays show that the latter are in cascade with β rays of maximum energy 315 kev. Consideration of the bias curve of these coincidences however shows that the coincidence β spectrum is complex and may be analysed into components of maximum energy 328 and 246 kev in the ratio 2:1 expected if they are in cascade with the 638- and 720-kev γ rays respectively, which are known to be emitted. This suggests that the latter are emitted in transitions to the ground state of Xe^{131}. (auth)

1923

INVESTIGATION OF γ SPECTRA WITH THE SCINTILLATION SPECTROGRAPH. D. Maeder and P. Preiswerk. Helv. Phys. Acta 24, 625-7(1951) Dec. 31. (In German)

Scintillation studies have resulted in a value of 1.045. ± 0.10 Mev for the γ radiation of Cu^{66}. Lines of 0.56 ± 0.01 and 1.1 ± 0.1 Mev have been observed for Rh^{104}. An upper limit of 0.205 Mev has been placed on the continuous γ radiation of Fe^{55}; this value gives the mass difference $Fe^{55}-Mn^{55}$ as 0.212 ± 0.010 Mev.

1924

ON THE QUESTION OF THE EXISTENCE OF SHORT-LIVED A^{39}. W. Hälg. Helv. Phys. Acta 24, 641-3(1951) Dec. 31. (In German)

Irradiation of K with fast neutrons from the Li + d reaction produced, in addition to 110-min A^{41}, only a 41-sec activity, which was attributed to Ne^{23} formed from Na impurity. This contradicts the existence of a 160-sec A^{39} recently reported, but not the possibility of a >15-yr A.

1925

THE DECAY OF Pt^{195}, Au^{195}, Pt^{197} AND Au^{199}. O. Huber, F. Humbel, H. Schneider, and A. De Shalit. Helv. Phys. Acta 24, 629-31(1951) Dec. 31. (In English)

If the first few excited states of odd nuclei can be explained by a single-particle shell model, then successive odd nuclei with the same ground states should have similar decay schemes. The dissimilarity noted in published energy-level diagrams of Pt^{195}, Hg^{197}, and Hg^{199} is in disagreement with this hypotheses. The decay schemes of Pt^{195m}, Au^{195}, Pt^{197}, Hg^{197m}, Au^{197m}, Au^{199}, and Hg^{199m} have therefore been reexamined by a coincidence technique. Corrected decay schemes are presented which show the outstanding similarity of the related nuclei.

1926

COMPLEX β DECAY OF Rb^{88}. Klaus Geiger. Ann. Physik (6) 9, 293-306(1951). (In German; cf. NSA 5-2955)

The β decay of 17.8-min Rb^{88} has been investigated in detail and found to be complex. Absorption measurements gave a maximum β energy β_1 of 5.20 ± 0.10 Mev, and coincidence studies showed two partial β spectra with maximum energies β_2 = 3.6 ± 0.3 Mev and β_3 = 1.8 ± 0.2 Mev. The relative intensities were β_1:β_2:β_3 = 4:1:1. The γ energies were determined by coincidence methods; two lines of 3.0 and 1.7 Mev with intensity ratio 1:10 were found. The decay scheme of Rb^{88} is sketched.

RARE EARTHS AND RARE-EARTH COMPOUNDS

1927

Radiation Lab., Univ. of Calif.

A STUDY OF THE ISOTOPES OF PROMETHIUM (thesis), by Vera Kistiakowsky Fischer. Jan. 8, 1952. 112p. (UCRL-1629)

Bombardments of isotopically enriched Nd samples have been performed with 8.9-Mev protons from the 60-in. cyclotron of the Crocker Radiation Laboratory and with protons at higher energies from the linear accelerator of the Radiation Laboratory of the University of California. Pr has been bombarded at various energies with α particles from the 60-in. cyclotron. The half lives and radiation characteristics of the Pm isotopes produced from these bombardments have been measured. The isotopes were identified chemically, and their mass allocations were determined on the basis of their relative yields. Nuclear shell theory was applied to explain ambiguities and to estimate the decay characteristics of unobserved Pm isotopes. Indirect confirmation of the theory was obtained in the coherence of the results. The following nuclides were characterized for the first time: Pm^{141}, Pm^{146}, and Pm^{150}. In addition, work on Pm isotopes previously described gave results indicating errors in the assignments of Pm^{143} and Pm^{144} and in the half life of Pm^{149}. A 42-day negatron-emitting nuclide was observed to be an isomer of either Pm^{147} or Pm^{148}. Limits were set on the half life of Pm^{142}. (auth)

SPECTROSCOPY

1928

Brookhaven National Lab.

SPECTROSCOPY OF RADIOACTIVE MOLECULES, by V. W. Cohen. Dec. 3, 1951. 21p. (BNL-1051)

An abstract of this report was indexed as BNL-1014 and appeared in Nuclear Science Abstracts as NSA 6-443.

1929

Duke Univ.

SPECTROSCOPIC STUDIES IN THE NEAR ULTRAVIOLET OF THE THREE ISOMERIC DIMETHYLBENZENE VAPORS. I. ABSORPTION AND FLUORESCENCE SPECTRA OF PARA DIMETHYLBENZENE; sect.5 of TECHNICAL REPORT NO. 6, by C. D. Cooper and M. L. N. Sastri. Dec. 20, 1951. 19p. (NP-3592(sect.5))

The near-ultraviolet absorption spectrum of p-xylene was photographed between 2850 and 2350 A at −40 to 100°C. The bands had slightly diffuse heads and were degraded toward the red. The p-xylene fluorescence spectrum, obtained by using a condensed Mn-spark source, extended from 3125 to 2720 A and consisted of about 45 diffuse bands similar in appearance to but much richer than the Tesla luminescence spectrum (J. Chem. Soc. 125, 1743(1924)). The electronic transition was interpreted as $^1A_{1_g} - {}^1B_{3_u}$ with a moment in the x direction and a O,O band at 36733 cm^{-1}. Bands toward the red from 35904 cm^{-1} were members of progressions or combinations of the totally symmetric 829- and 1208-cm^{-1} vibrations. Progressions corresponding to 775 and 1185 cm^{-1} in the excited state were correlated with 829 and 1208 cm^{-1} in the ground state and were tentatively associated with C-ring vibrations and the C-CH_3 valence combination. Fluorescence and absorption bands generally coincided in the overlap region. A weak portion of the spectrum was attributed to a forbidden transition involving the β_{1_g} component in the y direction of the ϵ_g^+ (606 cm^{-1}) C_6H_6 vibration; 648- and 552-cm^{-1} frequencies were assigned to the β_{1_g} component in the ground and upper states, respectively. The α_{1_g} component of the ϵ_g^+ C_6H_6 vibration in p-xylene had lower- and upper-state frequencies of 458 and 367 cm^{-1}, respectively. The relationship between the Tesla luminescence and the fluorescence and absorption spectra is discussed. (NRS abst.)

1930

ISOTOPE SHIFTS IN ERBIUM. L. Wilets and L. C. Bradley, III. Phys. Rev. 84, 1055-6(1951) Dec. 1.

An investigation of the isotope shifts in erbium (Z = 68) is being conducted using a Fabry-Perot interferometer. The oxide is excited in a hollow cathode discharge cooled with liquid N. Three components of the isotope shift are clearly resolved in more than fifty lines in the region between 4250 and 6000 A. The three components can be unambiguously attributed to the isotopes Er^{166}, Er^{168}, and Er^{170} on the basis of the intensity of the components compared with the relative abundances of the isotopes. The results of measurements on eleven lines are tabulated. The ratio $(\nu_{168}-\nu_{170})/(\nu_{166}-\nu_{168})$ is close to unity. Both positive and negative shifts are reported.

THEORETICAL PHYSICS

1931

Institute for Nuclear Studies, Univ. of Chicago

ON THE INVERSION PROPERTIES OF SPIN ½ FIELDS (SPECIAL SESSION), sect.IIC of NUCLEAR PHYSICS AND THE PHYSICS OF FUNDAMENTAL PARTICLES; PROCEEDINGS OF THE INTERNATIONAL CONFERENCE, SEPTEMBER 17 TO 22, 1951, by Jay Orear, A. H. Rosenfeld, and R. A. Schluter, eds. [nd] 2p. (NP-3591 (sect.IIC))

A special session was held to discuss the contents and implications of a paper by Yang and Tiomno (Phys. Rev. 79, 495-8(1951)) in which it is pointed out that four different transformations are possible under inversions for fields of spin ½. E. Fermi summarized the paper and defined the four classes of spin ½ fields proposed. The ensuing discussion is summarized.

1932

CONSERVATION LAWS IN FEYNMAN'S MODIFIED ELECTRODYNAMICS. P. N. Daykin. Can. J. Phys. 29, 459-62(1951) Nov.

In Feynman's treatment of the self-energy problem, the divergence is eliminated by introducing a convergence

factor into the integral over the virtual photon momentum space. Feynman has remarked that his choice of convergence factor is inconsistent with the conservation of energy for the radiation field of an atom. This problem is examined in a more general way. The modification of the Maxwell equations caused by the convergence factor is deduced. The modified field equations belong to the generalized electrodynamics described by Podolsky. The modified energy-momentum tensor is shown to satisfy the conservation law for the field with source. (auth)

1933
THE QUANTIZATION OF THE CLASSICAL THEORY OF SPINNING PARTICLES. S. Shanmugadhasan. Can. J. Phys. 29, 593-612(1951) Nov.

The classical theory of particles, possessing charge and dipole moment, and moving in an electromagnetic field, is considered on the assumptions that there is no constraint connection between the rotational variables and the velocity of the particle, and that the two invariant squares of the dipole moment six-vector are constants of the motion. Two different schemes are obtained according as the two invariant scalar products of the dipole moment and total spin angular momentum six-vectors are or are not constants of the motion. The Bhabha-Corben theory fits into the former scheme. The classical schemes are put into canonical form by using for each particle the relativistic connection between the momenta and the rest-mass, modified to include the effect of the kinetic and potential energies due to spin and dipole moment, as the Hamilton-Jacobi equation and the usual Poisson brackets for the translational and total spin variables. The Wentzel field and the λ-limiting process are used mainly in dealing with the field. The variational principle for the Bhabha-Corben equations is given with the field treated according to the limiting process of Dirac or the relativistic cutoff method of Feynman. The quantization is completed by using the analogy rules. The changes required when the interacting field is a vector meson field are discussed. (auth)

1934
AN ASYMMETRIC NUCLEAR MODEL. S. Gallone and C. Salvetti. Phys. Rev. 84, 1064-5(1951) Dec. 1.

Some features of an asymmetric nuclear shell model proposed by Rainwater (Phys. Rev. 79, 432(1950)) are discussed. A core is considered to be formed by the nucleons grouped in saturated orbits; this core is treated as a liquid drop whose surface acts on the remaining nucleons (extranucleons) as an impenetrable barrier. A perturbation method is applied to calculation of the energy shift of the extranucleons' energy levels. The equilibrium shape of the nucleus and the corresponding total energy variation are then calculated.

1935
RADIATION REACTION IN RELATIVISTIC MOTION OF A PARTICLE IN A WAVE FIELD. E. Gora. Phys. Rev. 84, 1119-23(1951) Dec. 15.

An approximate solution of the equations of motion of Dirac's classical theory of pointlike particles is obtained for a particle in the field of a plane wave, under the assumption that the radiation reaction terms in these equations can be considered as small. The appearance of runaway terms in this solution is avoided by letting the interaction set in gradually. Considerable simplification is achieved by restriction to the domain of high relativistic energies where the transfer of energy and momentum from the wave to the particle appears to be mainly due to radiation reaction. A quantitative discussion of the conditions of applicability of the formulas obtained is made possible by the assumption that there is correspondence between a photon and a classical wave train of finite length. This assumption leads to the conclusion that the classical formulas can be valid for arbitrarily high energies. An estimate of a lower limit for the duration of the interaction between particle and wave train yields an expression which resembles formulas for lifetimes of unstable particles both in its dependence upon fundamental constants and in its increase with the energy involved in the process. (auth)

1936
WAVE FUNCTIONS IN MOMENTUM SPACE. E. E. Salpeter. Phys. Rev. 84, 1226-31(1951) Dec. 15.

The integral equation satisfied by the momentum-space wave function $\phi(p)$ for a nonrelativistic two-body problem with a phenomenological central interaction potential is solved by means of an iteration method. A general prescription is given for finding suitable trial wave functions, which depend on some adjustable parameters. Reasonable values for these parameters are found by iteration of the wave function for particularly convenient values of the momentum. Successive iterations, giving better approximations $\phi_n(p)$ for $\phi(p)$, are carried out in a form suitable for numerical work. Besides $\phi_n(p)$, approximations are obtained for (a) the binding energy for certain bound states and (b) the phase shifts for scattering problems. For scattering at fairly low energies reasonable approximations are obtained with the same method both for weak and for fairly strong potentials. Extensions of the method are discussed for (a) two-body problems including tensor forces, (b) simple three-body problems, and (c) a relativistic equation for the two-body problem. (auth)

1937
RELATIVISTIC EQUATION FOR BOUND-STATE PROBLEMS. E. E. Salpeter and H. A. Bethe. Phys. Rev. 84, 1232-42(1951) Dec. 15.

The relativistic S-matrix formalism of Feynman is applied to the bound-state problem for two interacting Fermi-Dirac particles. The bound state is described by a wave function depending on separate times for each of the two particles. Two alternative integral equations for this wave function are derived with kernels in the form of an expansion in powers of g^2, the dimensionless coupling constant for the interaction. Each term in these expansions gives Lorentz-invariant equations. The validity and physical significance of these equations are discussed. One of these integral equations is applied to the deuteron ground state using scalar mesons of mass μ with scalar coupling. For neutral mesons the Lorentz-invariant interaction is transformed into the sum of the instantaneous Yukawa interaction and a retarded correction term. The value obtained for g^2 differs only by a fraction proportional to $(\mu/M)^2$ from that obtained by using a phenomenological Yukawa potential. For a purely charged meson theory a correction term is obtained by a direct solution of the relativistic integral equation using only the first term in the expansion of the kernel. This correction is due to the fact that a nucleon can emit, or absorb, positive and negative mesons only alternately. The constant g^2 is increased by a fraction of $1.1(\mu/M)$ or 15 . (auth)

1938
A CLASSICAL MODEL OF QUANTUM THEORY. K. F. Novobatzky. Ann. Physik (6) 9, 406-12(1951). (In German)

A new derivation of the Schroedinger wave equations is given which makes use only of pure mechanics and does not use optical analogies. Quantum mechanics is shown to differ from classical mechanics only by the introduction of anti-classical operator statistics.

1939
ON QUANTIZATION OF DIRAC'S NEW CLASSICAL THEORY. I. Jean G. Valatin. Compt. rend. 234, 64-7(1952) Jan. 2. (In French)

In attempting to apply the laws of wave mechanics to a continuous charged medium without spin, in a manner analogous to that of Dirac's recent theory of classical electrodynamics (Proc. Roy. Soc. (London) 209A, 291(1951)), the author was led to the equations of a previous theory of Dirac (Nuovo Cimento 7, 925(1950)). These equations are shown to reduce in the limit $\hbar \to 0$ to the classical equations. The elementary quantum e of charge appears only in the commutation relations of the second quantization

1940

ON QUANTIZATION OF DIRAC'S NEW CLASSICAL THEORY. II. Jean G. Valatin. Compt. rend. 234, 188-90 (1952) Jan. 7. (In French)

The Hamiltonian formulation of Dirac's theory of electrodynamics is discussed. The elimination of a potential component remains the critical point of the theory. One way to avoid singularities is to associate a nonzero mass constant with the electromagnetic field.

1941

ON NUCLEON-LEPTON INTERACTION IN THE THEORY OF β DISINTEGRATION. Robert Bouchez and Roger Nataf. Compt. rend. 234, 86-9(1952) Jan. 2. (In French)

Analysis of the nuclear matrix element corresponding to β transitions permitted for small Z shows that consideration as a purely tensor interaction is not satisfactory. The β transitions proceed 85% by a Gamow-Teller interaction and 15% by a Fermi-type interaction.

1942

THRESHOLD BEHAVIOUR IN QUANTUM FIELD THEORY. R. J. Eden. Proc. Roy. Soc. (London) 210A, 388-404(1952) Jan. 7.

The elements of the S matrix are functions of the energies and momenta of a set of incident particles. For sufficiently high relative energies of the incident particles new particles of non-zero rest mass can be created. At the thresholds for such creation processes the S matrix will have a complicated behavior. This behavior is investigated when the S matrix is calculated by means of renormalized quantum field theory. For a typical matrix element there are thresholds of two main types. The first is a creation threshold below which the element is zero on account of energy-momentum conservation; mathematically this is due to a Dirac δ function factor. The second is an interference threshold above which a competing process has non-zero probability. Interference thresholds are closely connected with the appearance of displaced poles in the integration. It is shown that a matrix element will always contain a term having a branch point at an interference threshold; the path of analytic continuation round these branch points is obtained from the physical assumption that particles interact through their retarded fields. Between the threshold values it is shown that the S matrix elements are analytic functions of the energies and momenta of the incident particles. (auth)

URANIUM AND URANIUM COMPOUNDS

1943

THE MAGNETIC SUSCEPTIBILITY OF URANIUM. C. J. Kriessman, Jr., and T. R. McGuire. Phys. Rev. 85, 71-2 (1952) Jan. 1.

Using a body force method, the magnetic susceptibility of U has been found to increase from 1.66×10^{-6} emu/g at −195°C to 2.16×10^{-6} emu/g at 1120°C. The room temperature value is 1.72×10^{-6} emu/g. Two abrupt increases in the susceptibility were observed at 698 and 808°C. (auth)

PATENTS

MINERALOGY, METALLURGY, AND CERAMICS

1944

IMPROVEMENTS IN OR RELATING TO PRODUCTION OF OXIDES OF SILICON, TITANIUM OR ZIRCONIUM. Saurefabrik Schweizerhall (Switzerland). Brit. Patent 655, 647, July 25, 1951.

An abstract of this patent appeared in Brit. Ceram. Abstracts, abst. 2751(1951) Nov.-Dec. and is reproduced here.

SiO_2, TiO_2, or ZrO_2 can be prepared in a state of extreme fineness by decomposition of the volatile chlorides at high temperature with an oxidizing gas. At least one of the reactants is introduced into the reacting chamber with a vortex motion. 16 figures.

AUTHOR INDEX

For each reference the digit preceding the dash is the volume number and digits after the dash are the abstract number.

NUMERICAL INDEX OF REPORTS

Numerical Index of Official Atomic Energy Reports with Indications of Their Availability

This list in the individual issues of Volume 6 supplements the Numerical Index of Reports with Indications of Their Availability which appears in NSA, Volume 5, No. 24. As reports are in manuscript form when abstracted for NSA, there may be some delay before the reports will be available at the Depository Libraries. The notation NSA in the Availability column indicates the appearance of a report in its entirety in NSA.

Abbreviations used below are:

NSA - NUCLEAR SCIENCE ABSTRACTS

ADD - ABSTRACTS OF DECLASSIFIED DOCUMENTS the predecessor of NSA

NNES - National Nuclear Energy Series, published by the McGraw-Hill Book Company

Code designations are assigned as follows:

MDDC - To declassified reports released by the Manhattan Engineer District and by the Atomic Energy Commission before March 1, 1948

AECD - To declassified reports released by the Atomic Energy Commission after February 29, 1948 (appeared in April 15, Nuclear Science Abstracts)

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Other code designations below are assigned to unclassified reports by the originating installations

Report	Abstract	Availability
AECD-3175	NSA 5-5165	J. Chem. Phys. 19, 1614(1951)
3211	5-5084	J. Am. Chem. Soc. 74, 824-5(1952)
3261	5-7301	Phys. Rev. 85, 157-8(1952)
3268	6-357	Phys. Rev. 85, 135-6(1952)
AECU-1018	5-567	J. Am. Chem. Soc. 74, 806-9(1952)
1137	5-2317	NSA
1221	5-3470	Rev. Sci. Instruments 22, 1020-21 (1951)
1399	5-4711	J. Am. Chem. Soc. 74, 825-7(1952)
1641	5-6917	Phys. Rev. 85, 129-33(1952)
1679	6-124	J. Chem. Phys. 19, 1612(1951)
1740	6-561	J. Am. Chem. Soc. 74, 856-7(1952)
1745	6-934	J. Chem. Phys. 19, 1242-3(1951)
1757	6-801	J. Chem. Phys. 19, 1504-8(1951)
1846	6-1375	NSA
AERE-T/R-679	5-5357	Proc. Roy. Soc. (London) 210A, 497-508(1952)
BNL-1014	6-443	NSA
1070	6-780	Am. Ind. Hyg. Assoc. Quart. 12, 151-4(1951)
1086	6-1388	NSA
ISC-157	5-5766	Phys. Rev. 85, 112-19(1952)
167	6-560	$0.40
173	5-6374	J. Chem. Phys. 19, 1610-11(1951)
K-728	NSA 5-3654	J. Am. Chem. Soc. 74, 749-53(1952)
LA-1200	5-3904	Rev. Sci. Instruments 22, 915-19 (1951)
NP-3348	5-6164	J. Chem. Phys. 19, 1551-3(1951)
NYO-899	5-7284	Phys. Rev. 85, 73-7(1952)
969	5-5265	Rev. Sci. Instruments 22, 1003-5 (1951)
1532	5-3408	$0.10
3034	6-1029	Phys. Rev. 84, 1262-3(1951)
ORNL-930	5-2535	Rev. Sci. Instruments 22, 981-6 (1951)
1013	5-5741	Rev. Sci. Instruments 22, 989-1002 (1951)
TID-5031	6-1186	$1.40
UCLA-150	5-4970	Proc. Soc. Exptl. Biol. Med. 78, 790-1(1951)
UCRL-990	5-5267	Rev. Sci. Instruments 22, 1006-8(1951)
1157	5-4090	J. Biol. Chem. 192, 415-24(1951)
1361	5-5033	J. Bact. 62, 195-7(1951)
1469	5-7304	Phys. Rev. 85, 146-7(1952)
1513	6-318	Phys. Rev. 85, 157(1952)
1550	6-701	NSA
1569	6-817	$0.10

NEW NUCLEAR DATA

The list in this issue contains chiefly results reported in July and August of 1951. These items, together with those already listed in previous issues, will be cumulated in NSA Vol. 6, No. 6B, an index number which will be issued in April. The cumulation will thus cover new data reported between July 1, 1951 and about December 1, 1951. Succeeding issues of NSA will list data published after December 1951 at the fastest possible rate. It is hoped that eventually the time lag between publication and listing will become about two months.

$_0n_1^1$	τ 13^m β^- 0.782 sl $p\beta^-$ coincidences		J. M. Robson, Phys. Rev. 83, 349(1951). F-K plot linear.
$_1H_1^2$	μ 0.857608 I $\nu(D)/\nu(H) = 0.15350612 \pm 0.00000005$		B. Smaller et al., Phys. Rev. 83, 812 (1951). $[D_2;H_2]$.
$_1H_2^3$	τ 12.4^y		W. M. Jones, Phys. Rev. 83, 537(1951).
$_1H_2^3$	β^- 0.0194 ± 0.0004 Neutrino mass ≤ 250 ev		D. R. Hamilton et al., Phys. Rev. 83, 215A (1951).
$_2He_2^4$	No large resonance in $H^3(p,\gamma)$ for $E_p < 3.4$ scin		C. E. Falk, G. C. Phillips, Phys. Rev. 83, 468(1951).
$_3Li_3^6$	Level Be(p,α) 2.187 EA		C. P. Browne et al., Phys. Rev. 83, 179 (1951).
$_3Li_4^7$	$p(\theta)$ indicates $Li^6(d,p)$ I(0.477 level) = ½ ppl		D. N. Dunbar, F. Hirst, Phys. Rev. 83, 164(1951).
$_3Li_4^7$	Level Li(d,d) 0.48		F. B. Shull, Phys. Rev. 83, 875A(1951).
$_4Be_4^8$	$\alpha(\theta)$ found $Li^6(d,\alpha)$ for $E_d = 0.2 - 1$ ppl		D. N. Dunbar, F. Hirst, Phys. Rev. 83, 164(1951).
$_4Be_5^9$	I ⅜ I q ~0.02?		J. Hatton et al., Phys. Rev. 83, 672 (1951). $[Be_3Al_2Si_6O_{18}]$.
$_4Be_5^9$	I (⅜)- $n(\theta)$ $E_d = 20$ $Be^9(d,n)$		L. Schecter, Phys. Rev. 83, 695(1951).
$_4Be_5^9$	Level $Be^9(p,p)$ 2.433 EA		C. P. Browne et al., Phys. Rev. 83, 179 (1951).
B	σ_a(th n) 730 osc		H. Pomerance, Phys. Rev. 83, 641(1951).
$_5B_5^{10}$	No 1.73 γ $Be^9(d,n)$ sl;pe^-		D. E. Alburger, Phys. Rev. 83, 184(1951).
$_5B_5^{10}$	n yield $Be^9(d,n)$ increase at $E_d = 0.91$, 2.3? $E_d = 0 - 3.5$.		E. B. Tucker, Phys. Rev. 83, 473(1951).
$_5B_6^{11}$	Levels $B^{10}(d,p)$ $p\gamma$ coincidences rates		H. H. Landon, Phys. Rev. 83, 1081(1951).
$_6C_6^{12}$	n yield $B^{11}(d,n)$ increase at $E_d = 1.3$ $E_d = 0 - 3.5$.		E. B. Tucker, Phys. Rev. 83, 473(1951).
$_7N_6^{13}$	I ½- or ⅜- $n(\theta)$ $E_d = 20$ $C^{12}(d,n)$		W. Heckrotte, L. Schecter, Phys. Rev. 83, 894A(1951).
$_7N_6^{13}$	Resonances $C^{12}(p,\gamma)$ $E_0 = 0.45, 1.700 \pm 0.008$		J. D. Seagrave, Phys. Rev. 83, 887A(1951).
$_9F_8^{17}$	$dn(\theta)$ Indicates $O^{16}(d,n)$ I(0.536 level) = ½ ppl		F. Ajzenberg, Phys. Rev. 83, 693 and 875A(1951).
$_9F_8^{17}$	No γ		V. Perez-Mendez, P. Lindenfeld, Phys. Rev. 83, 864(1951).
$_9F_9^{18}$	β^- 100% 0.649 sl No γ		L. Ruby, J. R. Richardson, Phys. Rev. 83, 698(1951). $F^{19}(p,pn)$.
$_9F_{10}^{19}$	Level $F^{19}(d,d)$ 1.52		F. B. Shull, Phys. Rev. 83, 875A(1951).
$_9F_{11}^{20}$	Q's $F^{19}(d,p)$ 4.55, 3.86, 3.57, 2.35, 1.85, 1.43, 0.81, 0.14		F. B. Shull, Phys. Rev. 83, 875A(1951).
$_{10}Ne_9^{19}$	τ 18.5^s β^+ 2.16 sπ		G. E. Schrank, J. R. Richardson, Phys. Rev. 83, 891A(1951). F(p,n).
$_{10}Ne_{10}^{20}$	Resonances for $O^{16}(\pi)$ $F^{19}(p,\alpha)$ E_0 Γ(kev) 0.710 35 0.842 24 1.130 43 1.236 58 1.367 26		G. C. Phillips, N. P. Heydenburg, Phys. Rev. 83, 184(1951).
$_{10}Ne_{10}^{20}$	n yield $F^{19}(d,n)$ increase at $E_d = 1.3$ $E_d = 0 - 3.5$.		E. B. Tucker, Phys. Rev. 83, 473(1951).
$_{11}Na_{10}^{21}$	τ 22.8^s β^+ <2.50? sπ 2.50 γ ~1.5 scin		G. E. Schrank, J. R. Richardson, Phys. Rev. 83, 891A(1951). Mg(p,α).
$_{11}Na_{11}^{22}$	$Mg^{24,25,26}(p)Na^{22}$ Yield curves $E_p = 2 - 95$		J. W. Meadows, R. B. Holt, Phys. Rev. 83, 1257(1951).

$_{11}Na^{24}_{13}$	γ 0.04% ~3.7 ic 4.1γ/disintegration $<10^{-6}$	L. E. Beghian et al., Phys. Rev. 83, 186 (1951).
$_{11}Na^{24}_{13}$	Na(n,γ) pair s Level scheme for 7 capture γ's	B. B. Kinsey et al., Phys. Rev. 83, 519 (1951).
Mg	σ_t(0.01 – 0.8) graph E_0 σ_0 J 0.085 23 ½ 0.275 13 ½ 0.430 13 ½	R. E. Fields, M. Walt, Phys. Rev. 83, 479 (1951).
$_{12}Mg^{25}_{13}$	Level Al(d,α) 0.584 s	H. Enge et al., Phys. Rev. 83, 31(1951).
$_{12}Mg^{25}_{13}$	Mg(n,γ) pair s Level scheme for 11 capture γ's	B. B. Kinsey et al., Phys. Rev. 83, 519 (1951).
$_{12}Mg^{26}_{14}$	Mg(n,γ) pair s Level scheme for 5 capture γ's	B. B. Kinsey et al., Phys. Rev. 83, 519 (1951).
$_{13}Al^{25}_{12}$	Levels Mg^{24}(p,p) 9 levels for E_p = 0.4 – 3.9 s,pc	F. P. Mooring et al., Phys. Rev. 83, 219A (1951).
$_{13}Al^{26}_{15}$	β^- 2.84* sl γ 1.78 sl;pe$^-$	H. T. Motz, Phys. Rev. 83, 215A(1951) and *verbal report.
$_{13}Al^{26}_{15}$	Level Al^{27}(d,p) 0.031 s	H. Enge et al., Phys. Rev. 83, 31(1951).
$_{13}Al^{28}_{15}$	Al(n,γ) pair s Level scheme for 29 capture γ's	B. B. Kinsey et al., Phys. Rev. 83, 519 (1951).
Si	σ_t(0.01 – 0.8) graph E_0 σ_0 J 0.195 12 ½ 0.570 8 >½	R. E. Fields, M. Walt, Phys. Rev. 83, 479 (1951).
$_{14}Si^{28}_{14}$	J* 2 or 3+ n(θ) E_d = 20 Al(d,n)	L. Schecter, Phys. Rev. 83, 695(1951). *Spin of Si^{28} excited.
$_{14}Si^{29?}_{15}$	μ 0.55 I assuming I = ½	J. Hatton et al., Phys. Rev. 83, 672(1951). [$Be_3Al_2Si_6O_{18}$].
$_{14}Si^{29}_{15}$	Si(n,γ) pair s Level scheme for 8 capture γ's	B. B. Kinsey et al., Phys. Rev. 83, 519 (1951).
$_{14}Si^{30}_{16}$	Si(n,γ) pair s Level scheme for 7 capture γ's	B. B. Kinsey et al., Phys. Rev. 83, 519 (1951).
$_{15}P^{32}_{17}$	Continuous γ spectrum $\gamma(E_\gamma > 0.09)/\beta^- = 0.0024$	L. Madansky, F. Rasetti, Phys. Rev. 83, 187(1951).
$_{16}S^{33}_{17}$	μ 0.64290 I $\nu(S^{33})/\nu(N^{14})$ = 1.06174 ± 0.00014	S. S. Dharmatti, H. E. Weaver, Phys. Rev. 83, 845(1951). [CS_2].
$_{16}S^{35}_{19}$	β^- 0.167 sl F-K plot linear to 0.032	R. B. Heller et al., Phys. Rev. 83, 848 (1951).
Cl	q coupling ratio Cl^{35}/Cl^{37} = 1.2686 M ± 0.0004 $\mu(Cl^{35})/\mu(Cl^{37})$ = 1.20136 ± 0.00005	V. Jaccarino, J. G. King, Phys. Rev. 83, 471(1951).
$_{17}Cl^{36?}_{21}$	Cl(th n,γ) scin E_γ = 5.5, 6.2 Other peaks	B. Hamermesh, V. Hummel, Phys. Rev. 83, 663(1951).
$_{18}A^{39?}_{21}$	τ 2.4^m	M. Hoffman, Phys. Rev. 83, 215A(1951).
$_{19}K^{38}_{19}$	τ 7.7^m β^+ 2.8 s γ	D. Green, J. R. Richardson, Phys. Rev. 83, 891A(1951). K(18 Mev p).
$_{20}Ca^{39}_{19}$	τ 1.1^{s*} β^+ 5.2* scin	D. J. Zaffarano, F. I. Boley, Phys. Rev. 83, 223A(1951) and *verbal report.
$_{22}Ti^{51}_{29}$	γ 0.32 scin	E. der Mateosian, Phys. Rev. 83, 223A (1951).
V	$\sigma_s$coh 0.028 (+) mir	A. W. McReynolds, R. J. Weiss, Phys. Rev. 83, 171(1951).
V	Resonance E_0 ~3300 ev	S. P. Harris, Phys. Rev. 83, 235A(1951).
$_{25}Mn^{56}_{31}$	Mn(th n,γ) scin E_γ = 5.0, 7.2 No line at 2.2	B. Hamermesh, V. Hummel, Phys. Rev. 83, 663(1951).
$_{25}Mn^{56}_{31}$	Mn(n,γ) E_γ = 5.32, 7.16 scin	R. W. Pringle, G. Isford, Phys. Rev. 83, 467(1951).
$_{26}Fe^{53}_{27}$	β^+ 2.6* scin F-K plot linear*	F. I. Boley, L. J. Laslett, Phys. Rev. 83, 215A(1951) and *verbal report.
$_{26}Fe^{57}_{31}$	Fe(th n,γ) scin E_γ = 6.0, 7.4, 8.6(Fe^{58}?) No line at 1.4.	B. Hamermesh, V. Hummel, Phys. Rev. 83, 663(1951).
$_{26}Fe^{59}_{33}$	β^- 0.45 sl γ ~50% 1.10 sl,pe$^-$ ~50% 1.29 No 0.26β, no $\gamma\gamma$	K. C. Mann, G. H. Hanson, Phys. Rev. 83, 893A(1951). Fe(n,γ).
Co	Resonance E_0 ~3600* ev	S. P. Harris, Phys. Rev. 83, 235A(1951) and *verbal report.
$_{28}Ni^{65}_{37}$	$\gamma\gamma(\theta)$ indicates dipole-quadrupole transitions	T. Wiedling, A. Carlsson, Phys. Rev. 83, 181(1951).
Cu	σ_a(th n) 3.57 osc	H. Pomerance, Phys. Rev. 83, 641(1951).
$_{29}Cu^{63}_{34}$	I ½ + ? n(θ) E_d = 20 Cu^{63}(d,n)	L. Schecter, Phys. Rev. 83, 695(1951).
$_{35}Br^{76}_{41}$	τ 17^h β^+ 2.2, 3.2 a γ 0.6 ?, 1.4 a X/β^+ = 0.7	S. C. Fultz, M. L. Pool, Phys. Rev. 83, 875A(1951). Se^{76}(8.3 Mev p,n); chem.

$_{38}Sr^{87}_{49}$	No X-ray resonance absorption, ~30 – 100 kev	R. H. McFarland, Phys. Rev. 83, 666 (1951).
$_{39}Y^{89}_{50}$	τ_1 14^s γ 0.92 scin α = 0.01 M4	M. Goldhaber et al., Phys. Rev. 83, 661 (1951). Y(fast n); d 80^{h}Zr; chem.
$_{39}Y^{89}_{50}$	τ_1 13^s γ 0.913 sπ;ce$^-$,scin d 80^{h}Zr	F. J. Shore et al., Phys. Rev. 83, 688 (1951).
Zr	σ_a(th n) 0.18 osc	H. Pomerance, Phys. Rev. 83, 641(1951).
$_{40}Zr^{89}_{49}$ 4.5^m	τ_1 4.4^m β^+ 0.36%* ~2.5 sπ γ 100%* 0.588 ce$^-$ scin α_K ~0.06 K/L + M ~7	F. J. Shore et al., Phys. Rev. 83, 688 (1951). *Relative intensities.
$_{40}Zr^{89}_{49}$ 80.1^h	β^+ 0.890 sπ p 13^{s}Y	F. J. Shore et al., Phys. Rev. 83, 688 (1951).
$_{40}Zr^{89}_{49}$ 80.1^h	K, β^+ to 14^{s}Y daughter K/β^+ ~3 0.92 γ in 14^{s}Y No other γ's s,scin,pc	M. Goldhaber et al., Phys. Rev. 83, 661 (1951).
$_{41}Nb^{94}_{53}$ 6.6^m	γ 0.9 scin	E. der Mateosian, Phys. Rev. 83, 223A (1951).
$_{42}Mo^{91}_{49}$	Mo(γ,n) threshold (15.5^m) = 13.2 threshold (75^s) = 13.1	R. Montalbetti L. L. Katz, Phys. Rev. 83, 892A(1951).
$_{42}Mo^{93}_{51}$	γ 0.262 sl;ce$^-$ K/L* = 2.9 0.687 sl;pe$^-$ 0.692 ce$^-$ 1.51 pe$^-$	L. Ruby, J. R. Richardson, Phys. Rev. 83, 698(1951). Nb(p,n). *E5.
$_{42}Mo^{101}_{59}$	γ 0.150 scin	E. der Mateosian, Phys. Rev. 83, 223A (1951).
$_{43}Tc^{93}_{50}$	β^+ 0.800 sl γ 1.32 scin (1.32γ)β^+ coincidences	G. E. Boyd, B. H. Ketelle, Phys. Rev. 83, 216A(1951).
$_{43}Tc^{95}_{52}$ 62^d	γ 0.202* scin 0.578* 0.804* 1.028*	G. E. Boyd, B. H. Ketelle, Phys. Rev. 83, 216A(1951) and *verbal report.
$_{43}Tc^{101}_{58}$	β^- 1.20 sl γ st 0.300* scin w 0.556* w 0.734* w 0.856?* (1.20β^-)(0.30γ)	G. E. Boyd, B. H. Ketelle, Phys. Rev. 83, 216A(1951) and *verbal report.
$_{43}Tc^{101}_{58}$	γ 0.260 scin	E. der Mateosian, Phys. Rev. 83, 223A (1951).
Ag	No X-ray resonance absorption, 80 – 100 kev	R. H. McFarland, Phys. Rev. 83, 666 (1951).
$_{47}Ag^{106}_{59}$	τ 24.0^m β^+ 29% 1.5 sπ 71% 1.94 β^-(?) 2% 0.4 ce$^-$ weak 0.5 γ's >0.6 scin,a	W. L. Bendel et al., Phys. Rev. 83, 677 (1951). Ag(γ,n).
Cd	σ_s/σ_a graph E_n = 0.02 – 0.4 ev $\Gamma_n/\Gamma(E_0 = 0.176) = 0.0051$	B. N. Brockhouse et al., Phys. Rev. 83, 840(1951).
$_{48}Cd^{111}_{63}$ 48.7^m	γ (0.149) scin α_K = 1.5 E3	A. W. Sunyar, Phys. Rev. 83, 864(1951).
$_{49}In^{114}_{65}$ 50^d	γ (0.192) s,ce$^-$ α_K = 2.4* K/L = 1.1 $\gamma\gamma(\theta)$ indicates I = 4,2,0	R. M. Steffen, Phys. Rev. 83, 166(1951). *E4.
$_{50}Sn^{119}_{69}$ ≥100^d	γ 0.02 scin	G. Scharff-Goldhaber et al., Phys. Rev. 83, 480(1951).
$_{50}Sn^{119}_{69}$ ≥100^d	γ 0.0242 sπ;ce$^-$ L/M ~ 4 0.0653 K/L = 0.51*, L/M ~ 4	R. D. Hill, Phys. Rev. 83, 865(1951). Sn^{118}(n,γ). *M4.
$_{51}Sb^{124}_{73}$	$\beta\gamma(\theta)$ suggests I = 1, 1, 0 or 3, 2, 0 b(E_β > 1) = −0.23	E. K. Darby, W. Opechowski, Phys. Rev. 83, 887A and 676(1951).
Te	σ_s incoh 0.6 σ_t (0.06 – 400 ev) graph E_0? 0.9,1.1,1.2,1.4,1.7 ev E_0 2.2 ev $\sigma_0\Gamma^2$ = 900 assigned to Te^{123}	C. Heindl, I. W. Ruderman, Phys. Rev. 83, 660(1951).
$_{52}Te^{123}_{71}$	μ −0.6 S	J. S. Ross, K. Murakawa, Phys. Rev. 83, 229A(1951).
$_{52}Te^{125}_{73}$	μ −0.7 S	J. S. Ross, K. Murakawa, Phys. Rev. 83, 229A(1951).
$_{53}I^{131}_{78}$	0.080 quanta/β^- ~2.6% ic 12^{d}Xe/β^- ~0.8%	E. W. Emery, Phys. Rev. 83, 679(1951).
$_{53}I^{131}_{78}$	β_1^- 0.255 sl β_2^- 0.607 γ_4 7.8* 0.6380 pe$^-$ γ_6 1 0.7239 (0.080γ)(β_2^-) (0.080γ)(β_1^-)?	S. Thulin, Phys. Rev. 83, 860(1951). Te(n,γ);ms. *Relative intensities.
$_{53}I^{132}_{79}$	γ 88%* 0.68 scin 0.8? 9.5% 1.41 2.4% 2.0 (0.68γ)(1.41γ) No (0.68γ)(2.0γ)	F. C. Maienschein et al., Phys. Rev. 83, 477(1951). *Relative intensities.
$_{55}Cs^{131}_{76}$	No β^+ sl No γ sl	R. Canada, A. C. G. Mitchell, Phys. Rev. 83, 76, 216A(1951).
$_{55}Cs^{134}_{79}$ 3.15^h	γ (0.128) scin α_K = 2.2 E3	A. W. Sunyar, Phys. Rev. 83, 864(1951). Cs(n,γ).

$_{55}Cs^{134}_{79}$ 2.3^{y}	β^-	25%	0.092	sπ	C. L. Peacock, J. L. Braud, Phys. Rev. 83, 484A(1951). $\alpha_K = 9.1 \times 10^{-3}$ $\alpha_K = 5.7 \times 10^{-3}$ $\alpha_K = 3.0 \times 10^{-3}$
		75%	0.648		
	γ		0.558		
			0.600		
			0.800		
			1.352		
$_{56}Ba^{131}_{75}$	γ	13*	0.122	sl;pe$^-$	R. Canada, A. C. G. Mitchell, Phys. Rev. 83, 76, 216A(1951). *Relative intensities from pe$^-$'s.
		44	0.196		
		53	0.213		
		14	0.241		
		120	0.371		
		1000	0.497		
$_{56}Ba^{133}_{77}$ 38.9^{h}	γ		0.275	sπ;ce$^-$	R. D. Hill, F. R. Metzger, Phys. Rev. 83, 455(1951). Cs(10 Mev d,2n); chem.
			$\alpha_K = 3$	scin	
$_{56}Ba^{135}_{79}$ 28.7^{h}	γ		0.267	scin; sl,ce$^-$	W. H. Cuffey, R. Canada, Phys. Rev. 83, 654(1951).
$_{56}Ba^{135}_{79}$ 28.7^{h}	γ		0.269	sπ;ce$^-$	R. D. Hill, F. R. Metzger, Phys. Rev. 83, 455(1951). Ba^{134}(pile n).
			$\alpha_K = 3.5$, K/L ~2		
$_{56}Ba^{140}_{84}$	τ		13.4^{d}		J. M. Cork et al., Phys. Rev. 83, 856 (1951). Fission. No 0.076γ.
	γ	0.0296	0.304	s;ce$^-$	
		0.132	0.537		
		0.162			
$_{57}La^{140}_{83}$	γ			s,ce$^-$	J. M. Cork et al., Phys. Rev. 83, 856(1951). Fission.
		0.069	0.241	0.752	
		0.109	0.265	0.816	
		0.110	0.329	0.926	
		0.131	0.431	1.597	
		0.173	0.486	1.904	
Ce	σ_a(th n)		0.80	osc	H. Pomerance, Phys. Rev. 83, 641(1951).
$_{58}Ce^{137}_{79}$	γ		0.2534	s;ce$^-$	H. B. Keller, J. M. Cork, Phys. Rev. 83, 216A(1951).
$_{58}Ce^{139}_{81}$	γ		0.1660	s;ce$^-$	H. B. Keller, J. M. Cork, Phys. Rev. 83, 216A(1951).
			0.2752		
$_{58}Ce^{141}_{83}$	β^-	0.42		s	E. Kondaiah, Phys. Rev. 83, 471(1951).
		0.57			
	γ		0.143	s;ce$^-$,pe$^-$	
$_{58}Ce^{141}_{83}$	γ		0.1457	s;ce$^-$	H. B. Keller, J. M. Cork, Phys. Rev. 83, 216A(1951) and *verbal report.
	No 0.315γ observed*				
$_{58}Ce^{143}_{85}$	β^-	~30%	0.37?		E. Kondaiah, Phys. Rev. 83, 471(1951).
		~40%	1.09	s	
		~30%	1.37		
	γ	~15%	0.057		
		~70%	0.283	s; ce$^-$, pe$^-$	
		~15%	0.649		
		~15%	0.705		
$_{58}Ce^{143}_{85}$	γ		0.0575	s;ce$^-$	H. B. Keller, J. M. Cork, Phys. Rev. 83, 216A(1951).
			0.2906		
	weak		0.3484		
$_{59}Pr^{141}_{82}$	μ value of 4.5669 due to Rb^{87} impurity				D. Williams, Phys. Rev. 83, 858(1951).
$_{59}Pr^{143}_{84}$	β^-		0.915	s	E. Kondaiah, Phys. Rev. 83, 471(1951).
$_{60}Nd^{147}_{87}$	τ		11.1^{d}		W. S. Emmerich, J. D. Kurbatov, Phys. Rev. 83, 40(1951). Nd(n,γ). β_3X, $\beta_3 e_1^-$, $\beta_2 e_2^-$, and $\beta\gamma$. No $\gamma\gamma$, γX, or XX.
	β_1^-	~25%	0.38	sl	
	β_2^-	~15%	0.60		
	β_3^-	~60%	0.825		
	γ_1		0.0915		
			K/L ~2.5		
	γ_2		0.320		
	γ_3		0.534		
Sm	σ_s/σ_a		graph		B. N. Brockhouse, D. G. Hurst, Phys. Rev. 83, 841(1951).
	E_n = 0.02 – 0.15 ev				
	$\Gamma_n/\Gamma(E_0 = 0.096)$ ~0.008				
$_{62}Sm^{150}_{88}$	Sm(th n,γ)			s;ce$^-$	C. T. Hibdon, C. O. Muehlhause, Phys. Rev. 83, 235A(1951).
	E_γ = 0.341 if K ce$^-$ was observed				
Gd	σ_s/σ_a indicates more than one level				B. N. Brockhouse, D. G. Hurst, Phys. Rev. 83, 841(1951).
Gd	σ_a(th n)		35,000	osc	H. Pomerance, Phys. Rev. 83; 641(1951).
$_{64}Gd^{158?}_{94}$	Gd(th n,γ)			s;ce$^-$	C. T. Hibdon, C. O. Muehlhause, Phys. Rev. 83, 235A(1951).
	E_γ = 0.080, 0.090, 0.185(?)				
Tb	σ_a(th n)		44	osc	H. Pomerance, Phys. Rev. 83, 641(1951).
Dy	σ_a(th n)		890	osc	H. Pomerance, Phys. Rev. 83, 641(1951).
Ho	σ_a(th n)		64	osc	H. Pomerance, Phys. Rev. 83, 641(1951).
$_{72}Hf^{175}_{103}$	γ	0.0891	0.228	sπ; ce$^-$ (Lu)	S. B. Burson et al., Phys. Rev. 83, 62, 222A(1951). Hf^{174}(n,γ).
		0.113	0.342		
$_{72}Hf^{179}_{107}$	τ		19^{s}		E. der Mateosian, M. Goldhaber, Phys. Rev. 83, 843(1951). Hf^{178}(n,γ).
	γ		~0.150	scin	
			α large, M3?		
			0.215		
	$e^-\gamma$, Xγ(delay <0.5$^{\mu s}$)				
$_{72}Hf^{179}_{107}$ 19^{s}	γ		0.161	s;ce$^-$	S. B. Burson et al., Phys. Rev. 83, 62, 222A(1951). Hf^{178}(n,γ).
			0.217	scin	
$_{72}Hf^{180}_{108}$ 5.5^{h}	τ		5.5^{h}		S. B. Burson et al., Phys. Rev. 83, 62, 222A(1951). Hf^{179}(n,γ); chem.
	γ	0.0568	0.330	sπ; ce$^-$ (Hf)	
		0.0932	0.442		
		0.214			
	(0.330γ)(0.442γ)				
$_{72}Hf^{181}_{109}$ 46^{d}	β^-		0.420	s	S. B. Burson et al., Phys. Rev. 83, 62, 222A(1951). Hf^{180}(n,γ).
	γ	0.133	0.481	s; ce$^-$ (Ta)	
		0.136	0.611		
		0.344			
	(0.420β)e$^-$ delay;			e$^-$e$^-$	
$_{73}Ta^{182}_{109}$ 16.4^{m}	γ		(0.180)	scin	A. W. Sunyar, Phys. Rev. 83, 864(1951). Ta(n,γ).
			α_K = 0.8	E3	

W	Isotope shifts $\Delta(W^{186}-W^{184}):\Delta(W^{184}-W^{182}):\Delta(W^{182}-W^{180}) = 1:1.13:1.02$		J. A. Vreeland, K. Murakawa, Phys. Rev. 83, 229A(1951).
$_{74}W^{183}_{109}$	μ +0.08 S		J. A. Vreeland, K. Murakawa, Phys. Rev. 83, 229A(1951).
Re	Resonances* E_0 2.1, 5.7, 7.1, 10.9(Re^{187}), 18		S. P. Harris, Phys. Rev. 83, 235A(1951) and *verbal report.
Ir	σ_a(th n) 440 osc		H. Pomerance, Phys. Rev. 83, 641(1951).
$_{77}Ir^{192}_{115}$ 70^d	τ 78^d 9 γ's assigned to β^- decay, 4 γ's to K		J. M. Cork et al., Phys. Rev. 83, 222A (1951). Ir(n,γ).
$_{77}Ir^{194}_{117}$	γ 0.3275 s;ce$^-$		J. M. Cork et al., Phys. Rev. 83, 222A (1951). Ir(n,γ).
$_{79}Au^{191}_{112}$	τ 18.0^h d 12.4^h Hg		J. H. Moon, A. L. Thompson, Phys. Rev. 83, 892A(1951).
$_{79}Au^{196}_{117}$	$\gamma\gamma(\theta)$ indicates I = 2,2,0		R. M. Steffen, D. M. Roberts, Phys. Rev. 83, 222A(1951).
$_{80}Hg^{191}_{111}$	τ 12.4^h K Soft, converted γ's Mass from daughters		J. H. Moon, A. L. Thompson, Phys. Rev. 83, 892A(1951). Au(60 Mev p); chem.
$_{80}Hg^{192}_{112}$	τ 8.4^h K Soft, converted γ's Mass from daughters		J. H. Moon, A. L. Thompson, Phys. Rev. 83, 892A(1951). Au(55 Mev p); chem.
$_{80}Hg^{193}_{113}$	τ_1 14.5^h τ_2 29.0^h K Soft, converted γ's Mass from daughters		J. H. Moon, A. L. Thompson, Phys. Rev. 83, 892A(1951). Au(45 Mev p); chem.
$_{80}Hg^{195}_{115}$	τ 38^h K Soft, converted γ's Mass from daughters		J. H. Moon, A. L. Thompson, Phys. Rev. 83, 892A(1951). Au(25 Mev p); chem.
$_{81}Tl^{208}_{127}$	γ 2.6147 ± 0.0006 H_ρ = 9988 ± 2 gauss cm (based on p resonance)		W. L. Brown, Phys. Rev. 83, 271(1951).
$_{82}Pb^{210}_{128}$	γ 100% 0.0464 sπ;ce$^-$ ce$^-$'s of other γ's <1%		J. M. Cork et al., Phys. Rev. 83, 681 (1951).
$_{82}Pb^{214}_{132}$	γ 0.0529 0.2946 sπ; 0.2415 0.3509 ce$^-$		J. M. Cork et al., Phys. Rev. 83, 681 (1951).
$_{82}Pb^{214}_{132}$	E_γ K^* L_1^* M_1^* N_1^* 0.240 415 60 17 sπ 0.294 480 75 20 0.350 540 95 30 5		S. Kageyama, J. Phys. Soc. (Japan) 6, 285 (1951). *Intensities of ce$^-$ lines relative to I(K line of 0.606γ of RaC) = 40.
$_{83}Bi^{210}_{127}$	Continuous γ spectrum $\gamma(E_\gamma > 0.09)/\beta^- = 0.0016$		L. Madansky, F. Rasetti, Phys. Rev. 83, 187(1951).
$_{83}Bi^{214}_{131}$	γ 0.0625 * 1.122 ** sπ; 0.1911 * 1.241 ** ce$^-$ 0.609 ** 1.419 0.769 ** 1.766 0.935		J. M. Cork et al., Phys. Rev. 83, 681 (1951). *Converted in Tl. **Converted in Po.
$_{84}Po^{200}_{116}$	τ 11^m K predominant α 5.84 ic		D. G. Karraker et al., Phys. Rev. 83, 390 (1951). Bi(100 Mev p); chem. p 27^hTl.
$_{84}Po^{201}_{117}$	τ 18^m K predominant α 5.70 ic		D. G. Karracker et al., Phys. Rev. 83, 390(1951). Bi(100 Mev p); chem. p 72^hTl.
$_{84}Po^{206}_{122}$	α 5.21 ic		D. G. Karraker et al., Phys. Rev. 83, 390 (1951).
$_{84}Po^{207}_{123}$	α 5.10 ic		D. G. Karraker et al., Phys. Rev. 83, 390 (1951).
$_{84}Po^{208}_{124}$	α 5.10 ic		D. G. Karraker et al., Phys. Rev. 83, 390 (1951).
$_{84}Po^{209}_{125}$	α 4.86 ic		D. G. Karraker et al., Phys. Rev. 83, 390 (1951).
$_{84}Po^{210}_{126}$	γ 0.784 sπ;ce$^-$		J. M. Cork et al., Phys. Rev. 83, 681 (1951).
$_{84}Po^{210}_{126}$	α 5.298 EA Based on Li(p,n) threshold = 1.882		W. J. Sturm, V. Johnson, Phys. Rev. 83, 542(1951).
$_{84}Po^{214?}_{130}$	γ 0.4575 sπ;ce$^-$		J. M. Cork et al., Phys. Rev. 83, 681 (1951).
$_{84}Po^{214}_{130}$	α 7.683 EA Based on Li(p,n) threshold = 1.882		W. J. Sturm, V. Johnson, Phys. Rev. 83, 542(1951).
$_{88}Ra^{138}$	γ 0.1856 sπ;ce$^-$		J. M. Cork et al., Phys. Rev. 83, 681 (1951).
$_{93}Np^{239}_{146}$	β_1^- 0.31 β_3^-0.70 sl β_2^- 0.44 γ_0^- 0.049 $\gamma_6$0.210 sl; γ_1 0.057 $\gamma_7$0.227 ce$^-$ γ_2 0.061 $\gamma_8$0.276 γ_3 0.067		R. L. Graham, R. E. Bell, Phys. Rev. 83, 222A(1951). $\gamma_3\gamma_8$. No $\gamma_7\gamma_8$. No $\beta_3\gamma$. $1.1\times10^{-3}\mu s$ delay between β_2 and γ_8, γ_7, and γ_8.
$_{93}Np^{239}_{146}$	β^- 0.34 0.65 sπ $\sqrt{2}$ 0.44 0.72 γ 0.0442 0.105 0.0490 0.209 0.0570 0.228 sπ $\sqrt{2}$; 0.0614 0.254 ce$^-$ 0.0675 0.277 0.286		E. P. Tomlinson et al., Phys. Rev. 83, 223A(1951).

Q's Between Ground States

$Be^{9}(p,\alpha)Li^{6}$	2.123 ± 0.004	C. P. Browne et al., Phys. Rev. 83, 179(1951).
$F^{19}(n,\gamma)F^{20}$	6.63 ± 0.03	B. B. Kinsey et al., Phys. Rev. 83, 519(1951).
$Al^{27}(n,\gamma)Al^{28}$	7.6	B. Hamermesh, V. Hummel, Phys. Rev. 83, 663 (1951).
$Al^{27}(n,)Al^{28}$	7.72 ± 0.01	B. B. Kinsey et al., Phys. Rev. 83, 519(1951).
$Al^{27}(d,p)Al^{28}$	5.494 ± 0.010	H. Enge et al., Phys. Rev. 83, 31(1951).
$Al^{27}(d,\alpha)Mg^{25}$	6.694 ± 0.010	H. Enge et al., Phys. Rev. 83, 31(1951).
$Si^{28}(n,\gamma)Si^{29}$	8.51 ± 0.04	B. B. Kinsey et al., Phys. Rev. 83, 519(1951).
$Si^{28}(d,p)Si^{29}$	6.246 ± 0.010	P. M. Endt et al., Phys. Rev. 83, 491(1951).
$Si^{29}(n,\gamma)Si^{30}$	10.55 ± 0.05	B. B. Kinsey et al., Phys. Rev. 83, 519(1951).
$P^{31}(d,\alpha)Si^{29}$	8.17 ± 0.02	P. M. Endt et al., Phys. Rev. 83, 491(1951).
$A^{40}(\gamma,p)Cl^{39}$	−10.8 ± 0.1	D. H. Wilkinson, J. H. Carver, Phys. Rev. 83, 466(1951).
$Mn^{55}(n,\gamma)Mn^{56}$	7.2	B. Hamermesh, V. Hummel, Phys. Rev. 83, 663 (1951).
$Mn^{55}(n,\gamma)Mn^{56}$	7.16 ± 0.05	R. W. Pringle, G. Isford, Phys. Rev. 83, 467(1951).
$Fe^{56}(n,\gamma)Fe^{57}$	7.4	B. Hamermesh, V. Hummel, Phys. Rev. 83, 663 (1951).

Packing Fraction Differences, Δf, in Units 10^{-4} amu

Doublet	Δf	Reference
$CH_4 - O$	22.777 ± 0.003	K. Ogata, H. Matsuda, Phys. Rev. 83, 180(1951).
$C_2H_4 - CO$	13.018 ± 0.002	
$N^{14} - CH_2$	−8.996 ± 0.001	
$N_2^{14} - C_2H_4$	−9.000 ± 0.002	
$N^{15} - CH_3$	−15.597 ± 0.003	

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